4 CLIMATE

CONCEPTS

- General weather conditions over a period of thirty years period is said to be the climate of a place.
- Temperature, atmospheric pressure, wind, humidity and precipitation are elements of weather and climate.
- Generalised monthly atmospheric conditions determine the basis on which the year is divided into the seasons — summer, winter or rainy.
- India has a monsoon type of climate.
- Monsoon is basically a seasonal reversal in the wind through the year.
- There is huge difference in temperature from one region to another.
- Form of precipitation, its amount and distribution also differ from one part of India to another.
- Coastal areas observe lesser difference in temperature conditions. It is the interior of India that experiences temperature contrasts.
- Decrease in rainfall is seen from east to west in the Northern Plains. All this influences diversity in professions, food, dress and houses of people.

Climatic Controls

- The interplay of latitude, altitude, distance from the sea, pressure and wind system, ocean currents and relief features determine climatic conditions of a place.

Factors Affecting India's Climate

- The Tropic of Cancer passes through the middle of the country from the Rann of Kuchchh to Mizoram.
- The Himalayas prevent the cold winds from central Asia from entering the subcontinent.
- The climate and associated weather conditions in India are governed by various atmospheric conditions namely pressure and surface winds, upper air circulation, western cyclonic disturbances and tropical cyclones.
- An apparent force caused by the earth's rotation is the Coriolis Force.
- Jet streams are narrow belts of high-altitude (above 12,000 m) westerly winds in the troposphere.
- The western cyclonic disturbances are weather phenomena of the winter months, brought in by the westerly flow from the Mediterranean region.

The Indian Monsoon

- The climate of India is strongly influenced by monsoon winds.
- The Inter Tropical Convergence Zone (ITCZ) is a broad trough of low pressure in equatorial latitudes where the northeast and the southeast trade winds converge.
- Reversal in the pressure conditions and eastern Pacific Ocean having lower pressure than eastern Indian Ocean is a periodic change in pressure condition known as the southern oscillation.
- El Nino is a warm ocean current that flows past the Peruvian coast in place of the cold Peruvian current, every 2 to 5 years.

The Onset of the Monsoon and Withdrawal

- The monsoon are pulsating winds affected by different atmospheric conditions encountered by it, on its way over the warm tropical seas.

- Monsoon arrives at the southern tip of the Indian peninsula generally by first week of June.
- The Arbain Sea and the Bay of Bengal branches of the monsoon merge over the north western part of the Ganga plains.
- The withdrawal or the retreat of the monsoon is a more gradual process which begins in the northwestern states of India by early September.
- The retreating monsoon or the transition season sees the change from hot rainy season to dry winter conditions.
- The low pressure conditions over northwestern India get transferred to the Bay of Bengal by early November causing cyclonic depressions originating over the Andaman Sea.

Distribution of Rainfall

- Owing to the nature of monsoons, the annual rainfall is highly variable from year to year.
- Areas of high rainfall are liable to be affected by floods while areas of low rainfall are drought prone.

The Seasons

- Four main seasons can be identified in India — the cold weather season, the hot weather season, the advancing monsoon and the retreating monsoon with some regional variations.
- In the cold weather season the northeast trade winds prevail over India.
- Days are warm and nights are cold.
- Frost is common in the north and the higher slopes of the Himalayas experience snowfall.
- The summer months experience rising temperature and falling air pressure in the northern parts of the country.
- A striking feature of the hot weather season are strong, gusty, hot, dry winds blowing during the day over the north and northwestern India called *loo.*
- In the advancing monsoon, i.e. the rainy season, the north-western region of the country receives the maximum rainfall.
- Monsoon has 'breaks' in rainfall, thus it has wet and dry spells.
- The alternation of dry and wet spells vary in intensity, frequency and duration causing heavy floods in one part and droughts in the others.

Monsoon as a Unifying Bond

- The dependence of farmers on rain, a change in seasonal cycle, variance in temperature, the needs of humans, plants and animals, festival dates etc., all depend on monsoon in India. In this way monsoon is a unifying bond for Indians.

I. SUMMATIVE ASSESSMENT

A. NCERT TEXTBOOK QUESTIONS

Questions Within The Lesson

Q.1. Find out why the houses in Rajasthan have thick walls and flat roofs. (Page 27)

Ans. Houses in Rajasthan have thick walls and flat roofs. The thick walls do not allow the heat to get into the houses while the flat roofs help to retain the little water that comes as rain in the desert (water harvesting).

Q.2. Find out why is it that the houses in the Tarai region and in Goa and Mangalore have sloping roofs. (Page 27)

Ans. The houses in Tarai region, Goa and Mangalore have sloping roofs so that the rainwater due to heavy rains in these area flow off the roof.

Q.3. Why are houses in Assam built on stilts? (Page 27)

Ans. The houses are built on stilts in Assam as there is danger of floods and wild animals in large areas of Assam.

Q.4. Why most of the world's deserts are located in the western margins of continents in the subtropics? (Page 27)

Ans. Sometimes the presence of cold coastal water can contribute to the creation of a desert along the adjoining shore. This occurs because cold ocean currents tend to stabilise the air over the coast and inhibit cloud formation. Large western coastal deserts include the Atacama Desert in Chile and the Namib Desert in Namibia.

Questions in the Exercise

Q.1. Choose the right answer from the four alternatives given below :

OR

(i) Which of the following places receives the highest rainfall ?

(a) Guwahati (b) Mawsynram (c) Kolkata (d) None of these

Ans. (b)

(ii) The wind blowing in the northern plains in summers is known as:

(a) Kaalbaisakhi (b) Loo (c) Trade winds (d) None of the above

Ans. (b)

OR

Where does the 'loo' flow in summer? (CBSE 2010)

(a) Peninsular India (b) North and Northwestern India

(c) Coastal regions (d) Eastern India

Ans. (b)

(iii) Which one of the following causes rainfall during winters in northwestern part of India?

(a) Cyclonic depression (b) Retreating monsoon

(c) Western disturbances (d) Southwest monsoon

Ans. Cyclonic depression

(iv) Monsoon arrives in India approximately in:

(a) Early May (b) Early July (c) Early June (d) Early August

Ans. Early June

(v) Which one of the following characterises the cold weather in India?

(a) Warm days and warm nights (b) Warm days and cold nights

(c) Cool days and cold nights (d) Cold days and warm nights

Ans. Cool days and cold nights

Q.2. Answer the following questions briefly.

(i) What are the elements affecting the climate of India?

Ans. The elements affecting the climate are temperature, atmospheric pressure, wind, humidity and precipitation.

(ii) Why does India have a monsoon type of climate?

Ans. India is defined as a climatic region with monsoon climate. It is strongly governed by the monsoon winds.

(iii) Which part of India experiences the highest diurnal range of temperature and why?

Ans. The Thar Desert has a wide difference between day and night temperatures. There is no sea around to moderate the range of variation of temperatures during day and night.

(iv) Which winds account for rainfall along the Malabar Coast?

Ans. Malabar Coast gets rains from depressions and cyclones.

(v) What are jet streams and how do they affect the climate of India?

Ans. Jet streams are high velocity westerly winds blowing through a narrow zone in the upper troposphere. The westerly flows are responsible for the western disturbances experienced in the north and north-western parts of the country. The easterly jet streams cause tropical depressions during the monsoon as well as October-November months.

(vi) Define monsoons. What do you understand by "break" in monsoon?

Ans. Monsoon refers to the seasonal reversal in the wind direction.

Monsoon 'break' refers to the happening of wet and dry spells during the rainy season. The monsoon rains take place only for a few days at a time. They are interspread with rainless intervals.

(vii) Why is the monsoon considered a unifying bond?

Ans. Monsoons are uncertain but all the same they act as a unifying force on the climatic unity of India. July and August are wet almost all over the country. In spite of their vagaries, the monsoons have a very important place in the cultural life of the people. There is so much poetry and music that centres round the rains. All over northern parts of India, there are festivals like Varsha Mangal and special songs for the seasons. For the farmers, the rains bring prosperity. The Indian landscape, its fauna and flora, its agriculture all revolve round the monsoon phenomenon. The arrival of rains is eagerly awaited.

Q.3. Why does rainfall decrease from east to the west in Northern India?

Ans. June onwards, there is continued low pressure over the north-west region. This attracts trade winds from the Indian Ocean. The winds are trapped by air circulation over India. These winds are loaded with abundant water vapours. The winds blow at a very fast speed. The hilly ranges of the northeast account for heavy rainfall in the region. As these winds travel westwards the amount of moisture contained goes on depleting. There is as such a decrease in rainfall *from east to west in northern India.*

Q.4. Give reasons as to why :

(i) Seasonal reversal of wind direction takes place over the Indian subcontinent.

Ans. With the reversal in the direction of the surface winds, the monsoons withdraw from the Northern Plains. This reversal occurs as the monsoon trough becomes weaker with the approach of winter months.

(ii) The bulk of rainfall in India is concentrated over a few months.

Ans. The bulk of rainfall is concentrated over the months of June-September. As winter approaches, there is a reversal in the direction of surface winds and monsoons withdraw from the Northern Plains.

(iii) The Tamil Nadu coast receives winter rainfall.

Ans. Winter rains in Tamil Nadu are caused by north-east trade winds (also known as north-east monsoons). That is the only part of India that gets rains during the winter months.

(iv) The delta region of the eastern coast is frequently struck by cyclones.

Ans. With the onset of winter season, there is a shift in low pressure conditions from the north-western plains to the Bay of Bengal. During the middle of November, this shift results in the occurrence of cyclones. The deltas of Krishna and Kaveri rivers (and also Bangladesh) have to bear the fury of these cyclones year after year.

(v) Parts of Rajasthan, Gujarat and the leeward side of the Western Ghats are drought-prone.

Ans. Rainfall in India is influenced by location as well as relief features. Areas situated in the direction of the monsoon winds receive more rainfall. The rainfall goes on decreasing from east to west. The moisture content of the monsoons goes on decreasing as they move westward. Areas situated in extreme west and devoid of hilly ranges that intercept the monsoon remain drought prone.

Q.5. Describe the regional variations in the climatic conditions of India with the help of suitable examples.

Ans. There are wide variations in climatic conditions over different parts of the country. Most parts of the country have dry winters. The Coromandel coastal areas are an exception.

Winters are severe in the north. The temperature increases from north to south. As the Northern Plains shiver with 10-15 degrees Celsius temperature, Chennai has temperature around 25 degree Celsius. Higher slopes of the Himalayas experience snowfall. The peninsular region does not have a well defined cold season. Nearness to the sea ensures that there are no wide variations due to seasonal changes.

Rainfall may go up to 1080 mm in the Khasi hills. Rajasthan and parts of Gujarat remain prone to droughts. During the summer seasons temperatures go up to 48 ^{o}C in the western parts of India. May is the season of loo. These hot and dry winds cause intense heat. Temperature variations (June-December) are minimal at places like Leh. Places in the Northern Plains experience *severe heat in the summers and extreme cold weather during the winter months.*

Q.6. Discuss the mechanism of monsoons.

Ans. The north-east trade winds that blow during the winter months get replaced as the summer season sets in. There is continued low pressure over the north-west region. This attracts trade winds from the Southern Hemisphere. Coming from the Indian Ocean, these winds cross over the Bay of Bengal and the Arabian Sea. They are then trapped by air circulation taking place over India. These winds are loaded with moisture and blow at a very fast speed. The rain caused by south-west monsoon is not uniform. The areas of Western Ghats situated in the direction of the winds get more rainfall than the other side.

The cyclonic depressions formed at the head of the Bay of Bengal cause uneven and uncertain distribution of rainfall. These depressions move towards the low pressure monsoon trough which is not steadily placed. For a variety of reasons, they move northwards or southwards.

When the axis of the trough moves close to the Himalayas, there are heavy rains in the Himalayan regions. The plains get dry spells. With the approach of winter, the monsoon trough becomes weaker. There is reversal in the direction of surface winds with the approach of winter. The monsoons now withdraw from the Northern Plains. The shift in the low pressure conditions from north-western plains to the Bay of Bengal causes cyclones and rains in the Coromandel Coast.

Q.7. Give an account of weather conditions and characteristics of the cold season.

Ans. The winter season lasts from the month of December to February. The season is mostly dry. Cold is severe in the northern parts of the country. The southern parts have only mild cold. In the Northern Plains the days may be generally warm but the nights are cold. Places situated at high altitudes have snowfall.

Light rainfall may occur during the winter months caused by western disturbances. These disturbances are caused by shallow cyclonic depressions originating over the east Mediterranean Sea. Travelling eastward, these depressions reach the north-western parts of India. On their way these get loaded with moisture from the Caspian Sea and the Persian Gulf. The western disturbances are responsible for snowfall in the western Himalayan regions apart from light rains over north-western parts of the country.

Winter rains are often followed by cold waves. Tamil Nadu gets rains in winter by the north-east trade winds.

Q.8. Give the characteristics and effects of the monsoon rainfall in India.

Ans. The monsoon rainfall in India is not evenly distributed. Rainy season has a longer spell in the eastern parts of the country. The northwest gets rains for barely two months. The duration of the rainy season is longer in the south than in the north.

The southwest monsoon pours more water over areas of Western Ghats that are situated in the direction of the winds. The quantity of rainfall is heavy in the hilly regions of the north-east. It keeps declining as the winds move westwards. Patna gets more rain than Allahabad. Similarly, Delhi gets much less rain than Kolkata.

Monsoons are not steady. Rainy days are interspersed with rainless days.

When the rains are heavy, the rivers get flooded causing heavy damage in the plains year after year. A dry spell would cause as much misery as the river floods. The arrival and departure of monsoons is uncertain. So is the extent of rainfall in any given rainy season. These characteristics of monsoon has a very destabilising effect on Indian economy that continues *to be predominantly agricultural and severely dependent on rainfed irrigation.*

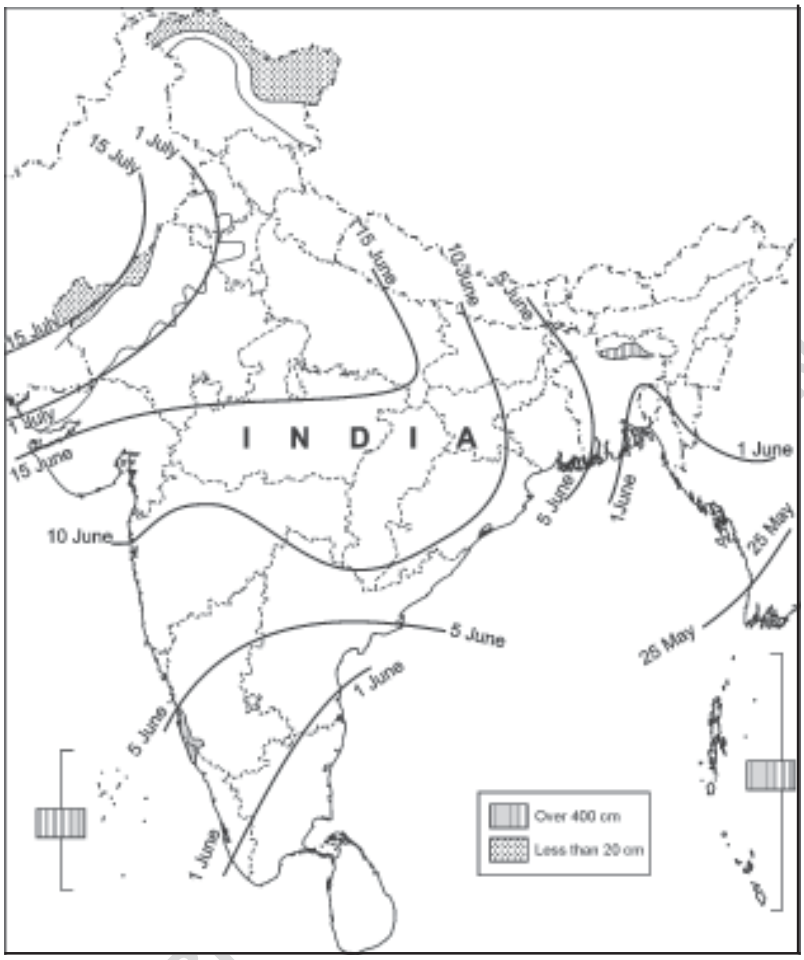
MAP SKILLS

Q.1. On an outline map of India, show the following.

(i) Areas receiving rainfall over 400 cm.

(ii) Areas receiving less than 20 cm of rainfall.

(iii) The direction of the southwest monsoon over India.



OTHER IMPORTANT QUESTIONS (AS PER CCE PATTERN)

B. MULTIPLE CHOICE QUESTIONS (1 MARK)

Q.1. Which of the following terms refers to the sum total of weather conditions and variations over a large area for a long period of time (more than thirty years)?

(a) Atmosphere (b) Annual range of temperature

(c) Climate (d) Monsoons

Ans. (c)

Q.2. Which of the following is not an elements of weather and climate?

(a) Atmospheric pressure (b) Temperature

(c) Humidity (d) Altitude

Ans. (d)

Q.3. Which of the following statements defines weather?

(a) Envelope of air surrounding earth

(b) State of the atmosphere over an area at any point of time
(c) Atmospheric conditions over a large area for a long period of time
(d) Generalised monthly atmospheric conditions.

Ans. (b)

OR

Which one of the following terms is used for the state of atmosphere over an area at any point of time ?

(a) Weather (b) Winds (c) Climate (d) Pressure

Ans. (a)

Q.4. In which of the following places of India precipitation is in form of snowfall?

(a) Shillong (b) Drass (c) Chandigarh (d) Haridwar

Ans. (b)

Q.5. Which of the following places of India experiences the highest summer temperature?

(a) Pahalgam (b) Leh (c) Thiruvananthapuram (d) Jaisalmer

Ans. (d)

Q.6. Which of the following is the rainiest station?

(a) Shillong (b) Mumbai (c) Chennai (d) Kolkata

Ans. (a)

Q.7. Which one of the following is the driest station?

(a) Mumbai (b) Leh (c) Bengaluru (d) Delhi

Ans. (b)

Q.8. Most parts of India receive rainfall during which of the following months?

(a) December to February (b) March to May
(c) June to September (d) October to November

Ans. (c)

Q.9. In which of the following months does the Tamil Nadu coast get most of its rainfall?

(a) December to February (b) March to May
(c) June to September (d) October to November

Ans. (d)

Q.10. Which of the following places in India experiences a very high diurnal range of temperature?

(a) Kolkata (b) Jodhpur (c) Chennai (d) Delhi

Ans. (b)

Q.11. In which of the following places of India there is very little difference between day and night temperatures?

(a) Guwahati (b) Nagpur (c) Thiruvananthapuram (d) Delhi

Ans. (c)

Q.12. In which of the following places are houses built on stilts?

(a) Assam (b) Rajasthan (c) Goa (d) Kerala

Ans. (a)

Q.13. Which one of the following is not one of the six major controls of the climate of any place?

(a) Latitude (b) Temperature
(c) Pressure and wind system (d) Distance from the sea

Ans. (b)

Q.14. Latitude and altitude of a place determine which of the following climatic elements of a place?

(a) Pressure and wind system (b) Temperature
(c) Rainfall pattern (d) All the above

Ans. (d)

Q.15. Which of the following places have cooler climate even during summers?

(a) Allahabad (b) Mumbai (c) Mussoorie (d) Amritsar

Ans. (c)

Q.16. Which of the following places of India experiences extreme type of climate?

(a) Shillong (b) Bengaluru (c) Chennai (d) Delhi

Ans. (d)

Q.17. Due to which of the following factors does Pune receive much lesser rainfall as compared to Mumbai?

(a) It is located on the leeward side of Western Ghats
(b) It is located on windward side of Western Ghats
(c) Continentality (d) Distance from the sea

Ans. (a)

Q.18. Which of the following latitudes passes through the middle of our country, giving it the characteristics of tropical as well as subtropical climate?

(a) Tropic of Capricorn (b) Tropic of Cancer (c) Equator (d) 82°30'N

Ans. (b)

Q.19. The Indian subcontinent experiences comparatively milder winters as compared to Central Asia due to which of the following factors?

(a) The Tropic of Cancer (b) The surrounding seas
(c) The Himalayas (d) Ocean currents

Ans. (c)

Q.20. Which of the following atmospheric conditions govern the climate and associated weather conditions in India?

(a) Pressure and surface winds
(b) Upper air circulation
(c) Western cyclonic disturbances and tropical cyclones
(d) All the above

Ans. (d)

Q.21. Which of the following winds brings widespread rainfall over the mainland of India?

(a) Northeasterly (b) Westerlies
(c) Southwest monsoon winds (d) Sea breeze

Ans. (c)

Q.22. Which of the following is a component of upper air circulation?

(a) North-easterlies (b) Jet stream

(c) South-west monsoon (d) Kal Baishakhi

Ans. (b)

Q.23. From which of the following pressure belts do the north-easterly trade winds originate?

(a) Equatorial low pressure belt

(b) Subtropical high pressure belt of the Northern Hemisphere

(c) Subtropical high pressure belt of the Southern Hemisphere

(d) Temperate low pressure belt of the Northern Hemisphere

Ans. (b)

Q.24. Due to which of the following reasons are the southwest monsoons rainbearing winds?

(a) They blow from low pressure area of northeastern India towards the seas

(b) They are seasonal winds

(c) They blow over warm Indian Ocean and gather moisture

(d) They strike the Himalayas

Ans. (c)

Q.25. Which of the following prevents the southwest monsoon winds from escaping from India?

(a) The surrounding seas (b) The Himalayas

(c) Low pressure over Central Asia (d) The Indian deserts

Ans. (b)

Q.26. The word monsoon is derived from a word which literally means which of the following?

(a) Seasons (b) Wind pattern (c) Change (d) Mausumbi

Ans. (a)

Q.27. In which of the following stations of India's mainland does the monsoons arrive first?

(a) Thiruvananthapuram (b) Kolkata

(c) Chennai (d) Delhi

Ans. (a)

Q.28. By which of the following dates do southern parts of our islands receive their first monsoon showers?

(a) First week of April (b) First week of May

(c) First week of June (d) Mid-October

Ans. (a)

Q.29. Which of the following stations of India experiences snowfall in winter?

(a) Aurangabad (b) Guwahati (c) Ooty (d) Srinagar

Ans. (d)

Q.30. Which of the following causes rainfall in West Bengal during the hot weather season?

(a) Mango showers (b) Kal Baishakhi

(c) Southwest monsoon (d) Retreating Monsoon

Ans. (b)

Q.31. In which month the transition season changes the hot rainy season to dry winter season? (CBSE 2010)

(a) December to February (b) February to March
(c) June to July (d) October to November

Ans. (d)

Q.32. The term monsoon is originated from? (CBSE 2010)

(a) German (b) Hindi (c) Latin (d) Arabic

Ans. (d)

Q.33. Kal Baisakhi is associated with

(a) Punjab (b) Kashmir (c) Karnataka (d) Bengal

Ans. (d)

Q.34. The peninsular part of India experiences peak summers earlier than northern India because : (CBSE 2010)

(a) There is less rainfall in the peninsula during that time.
(b) Cold waves from Central Asia sweeps through the northern plains during the time.
(c) Due to northward movement of the sun, the global heat belt shifts northward
(d) Clouds do not form in those months

Ans. (c)

Q.35. Bengal, Orissa and Andhra Pradesh coasts are frequented by cyclones because (CBSE 2010)

(a) The level coastline makes the cyclones penetrate these areas earlier
(b) These areas are close to a volcano
(c) Low pressure conditions in northwest India lead to the creation of depression over Andaman sea.
(d) Heavy rainfall in these parts encourage strong wind conditions

Ans. (c)

Q.36. Mango showers occur in which one of the following group of two states? (CBSE 2010)

(a) Bihar and West Bengal (b) Tamil Nadu and Andhra Pradesh
(c) Karnataka and Kerala (d) Maharashtra and Andhra Pradesh

Ans. (c)

Q.37. Which is the coldest place in India? (CBSE 2010)

(a) Drass (b) Srinagar (c) Shillong (d) Bikaner

Ans. (a)

Q.38. Which area is not an area of low precipitation?

(a) Western Rajasthan and Gujarat (b) Leh in Jammu and Kashmir
(c) Deccan plateau (d) Assam

Ans. (d)

Q.39. In winter the western cyclonic disturbances originate from which sea? (CBSE 2010)

(a) Mediterranean Sea (b) Indian Ocean (c) Caspian Sea (d) Arabian Sea

Ans. (a)

Q.40. Which one of the following states suffers from loo? (CBSE 2010)

(a) Tamil Nadu (b) Uttar Pradesh (c) Gujarat (d) None of these

Ans. (c)

C. SHORT ANSWER TYPE QUESTIONS (3 MARKS)

Q.1. What are jetstreams? How do they affect the climate? (Important)

Ans. Jetstreams are a narrow belt of high speed, high altitude, westerly winds in the troposphere. Jetstreams are an important component of the upper air circulation. They are located at an altitude of above 12000 metres. Their speed varies from 110 km/hr in summer to about 184 km/hr in winter. The most constant jetstreams identified are the mid-latitude and the subtropical jetstreams.

Over India, jetstreams blow south of the Himalayas, all through the year except summer.

The western cyclonic disturbances are experienced in the north and northwestern parts of the country during winter months. They are brought in by the flow of westerly jetstream from the Mediterranean region.

In summer when the subtropical westerly jetstream moves north of the Himalayas, an easterly jetstream, called the tropical easterly jetstream blows over Peninsular India, approximately over 14°N latitude. Tropical cyclones that occur during the monsoons as well as in October-November are influenced by the tropical easterly jetstreams. The easterly flow brings tropical cyclones from the Bay of Bengal to the coastal regions of Orissa and Andhra Pradesh.

Q.2. What is the loo? How does it affect the weather of a place? (Important)

Ans. The strong, gusty, hot, dry winds blowing during the day over the north and northwestern India during summer are known as 'loo'. The 'loo' is a striking feature of the hot weather season from April to June. Loo usually occurs during the afternoon but sometimes it even continues until late in the evening.

Direct exposure to these winds may even prove to be fatal. They cause acute dehydration and sunstroke. During May and June they sometimes bring duststorms which bring temporary relief as they lower the temperatures and may bring light rain and cool breeze.

Q.3. Write a short note on the retreating monsoons. (Important)

Ans. The months of October-November mark a period of transition from hot rainy season to cold dry winter conditions. This period is known as Retreating Monsoon or Transition season because the southwest monsoons weaken and withdraw or retreat from India.

The retreat of monsoon is marked by clear skies and rise in temperature. While days are warm, nights are cool and pleasant. Owing to high temperature and high humidity, weather becomes oppressive. This phenomenon is known as 'October heat'.

With the shift of low pressure centre to the Bay of Bengal in early November, cyclonic depressions originating over the Andaman Sea move over the Eastern Coast. The Coromandel coast receives bulk of its rainfall from the retreating monsoons.

These tropical cyclones cause heavy destruction and torrential rains in thickly populated deltaic regions of Tamil Nadu and Andhra Pradesh.

Q.4. Describe with examples how altitude affects the climate of a place.

Ans. Altitude plays an important role in influencing the climate of a place. As one goes up to higher altitudes away from the surface of the earth, the atmosphere becomes less dense and temperature decreases. As a result hill stations like Mussoorie, Darjeeling and Udagamandalam (Ooty) in the south are cooler even during summer.

The decrease in temperature with altitude also has its effects upon the pressure system which in turn determines the wind pattern and hence precipitation.

Drass, Srinagar and Shimla, located on the higher slopes of the Himalayas, receive heavy snowfall during winter due to inflow of western disturbances to areas with sub-zero temperatures.

The lofty Himalayas, on account of their high altitude, stand as a barrier and protect India from bitterly cold winds of Central Asia during winter. They also confine the rainfall from the monsoons to the mainland of India.

Places at lower altitudes, mainly those along the coast like Mumbai, Chennai, Kolkata, have moderate climates.

Q.5. Describe with examples how distance from the sea influences the climate of a place?

Ans. The sea exerts a moderating influence on the climate of a place. Places like Mumbai, Chennai, Thiruvanthapuram, Kolkata located near the sea have equable climate or maritime climate with less difference between summer and winter temperatures. As the distance from the sea increases, its moderating influence decreases. Places away from the sea are said to have continental location. Continentality is marked by extreme weather conditions, i.e., very hot summer and very cold winter. For example, Delhi located in the interior of the country at a distance from the sea experiences an extreme type of climate.

Q.6. What form of precipitation does the upper part of the Himalayas receive and why?

Ans. The upper parts of the Himalayas have quite high altitude of around 6000 metres. Temperature is very low in these parts as temperature decreases with a rise in altitude. Precipitation takes place in the form of snowfall in all stations in the upper parts of the Himalayas due to freezing temperatures. For example, Drass located in Jammu and Kashmir records minus 45°C (–45°C) temperature on a winter night. Hence, precipitation in this region is in the form of snowfall. Srinagar in the valley of Kashmir, Shimla and Manali in Himachal Pradesh and other hill stations in the upper parts of Himalayas receive snowfall in winter due to inflow of western cyclonic disturbances from the west.

Q.7. Write a short note on the trade winds. What are the effects of trade winds on the climate of India?

Ans. The planetary winds blowing from the Sub-Tropical High Pressure Belts to the Equatorial Low Pressure Belt or Doldrums are termed as 'Trade Winds'.

On account of the Laws of Deflection due to the Coriolis force, they blow as North-East Trade Winds in the Northern Hemisphere and as South-East Trade Winds in the Southern Hemisphere. The trade winds are the most permanent and regular of all planetary winds. They blow with great force in a constant direction.

India lies in the region of Northeasterly Trade Winds. As they originate and blow over land, the Northeasterly Trade Winds generally carry very little moisture. Therefore, they bring little or no rainfall. Hence, had trade winds been the only factor influencing India's climate, India would have been an arid land.

In late summer low pressure condition over Northern Plains intensifies. This attracts the trade winds of the Southern Hemisphere. The Southeast Trade Winds originating over warm sub-tropical areas of southern oceans cross the equator and blow in a southwesterly direction to India. They are moisture laden and bring rainfall to India as southwest monsoon.

Q.8. Discuss why Mawsynram receives the highest rainfall in the world? (Important)

Ans. Mawsynram in Meghalaya is located on the southern ranges of the Khasi Hills. When the rain bearing winds from the Bay of Bengal branch of monsoons strike the Garo, Khasi and Jaintia

hills, they cause very heavy rainfall in the northeastern states located here. As Mawsynram is located at a position perpendicular to the path of the rainbearing winds which enters the deep valley of the Khasi hills, it receives rainfall of about 1141 cm per year. Hence, Mawsynram receives the highest rainfall in the world. Rainfall occurs here for almost nine months of the year.

Q.9. What is the Coriolis force? Describe briefly its effect on the climate of the world.

Ans. An apparent force caused by the earth's rotation is called the Coriolis force. The Coriolis force is responsible for deflecting the direction of the winds towards the right in the Northern Hemisphere and towards the left in the Southern Hemisphere. This is also known as 'Ferrel's Law'.

Under the effect of Coriolis force the trade winds moving from Sub-Tropical High Pressure belts to Equatorial Low Pressure belts become Northeast Trade Winds in the Northern Hemisphere and Southeast Trade Winds in Southern Hemisphere. As a result, they bring heavy rainfall to the east coast of continents within tropics after passing over oceans. As they are offshore on the west coast, these regions turn into hot deserts.

Westerly winds blowing from Sub-Tropical High to Temperate Low Pressure belts become the South-Westerlies in the Northern Hemisphere and the Northwesterlies in the Southern Hemisphers due to Coriolis force. They bring much precipitation to western coast of continents, mainly in Southern Hemisphere.

Q.10. Give reasons why the bulk of the rainfall is concentrated over a few months in India. (Important)

Ans. The major part of the annual precipitation of India is due to the southwest monsoons. The reasons behind concentration of rainfall over few months are as follows :

(a) By early June the low pressure zone over northern India intensifies and attracts the moisture laden Southwest monsoons. These onshore winds are the main source of rainfall in India. As they originate as southeast trade winds over warm subtropical southern oceans they bring abundant moisture.

(b) The advancing southwest monsoons strike the southern part of the peninsula in early June and by July, it has its sway over entire India. The duration of monsoon is between 100-120 days from early June to mid-September. Bulk of the rainfall of India is concentrated within these months. This period is known as rainy season.

(c) The Arabian Sea branch and Bay of Bengal branch of monsoon bring heavy rainfall of over 400 cm in West Coast areas and northeastern states. Even dry areas like Rajasthan and Gujarat receive some rain.

Q.11. Study the climate data of the given place and answer the following questions : (CBSE 2010)

Months	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Rainfall
Temperature in °C	20.5	22.7	25.2	27.1	26.7	24.2	23.0	23.0	23.1	22.9	18.9	20.2	
Rainfall in (mm)	7	9	11	45	107	71	111	137	164	153	61	13	889

(a) Find out the annual of temperature of the given place.

(b) Name the rainiest month.

(c) Which month receives least rainfall and how much ?

Ans. (a) Annual range of temperature = 27.1 – 18.9 = 8.2 °C

(b) September

(c) Jannuary receives the least rainfall = 7 mm.

Q.12. Read the given table and answer the following questions. **(CBSE 2010)**

(a) Name two rainiest stations

(b) Name the station farthest from equator

(c) Station which has highest range of temperature

Stations	Latitude	Altitude	Jan. (Meters)	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Rainfall	Annual Range of Temp.
Temperature (°C) Bangalore Rainfall (cm)	12.58'N	909	20.50.7	22.2 0.9	25.2 1.1	27.1 4.5	26.7 10.7	24.2 7.1	23.0 11.1	23.1 13.7	22.9 16.4	18.9 15.3	18.9 6.1	20.2 1.3	88.9	8.2
Temperature (°C) Mumbai Rainfall (cm)	19'N	11	24.40.2	24.4 0.2	26.7	28.3	30.0 1.8	28.9 50.6	27.2 61.0	27.2 36.9	27.2 26.9	27.8 4.8	27.2 1.0	25.0	183.4	5.6
Temperature (°C) Kolkata Rainfall (cm)	22.34'N	6	19.61.2	22.0 2.8	27.1 3.4	30.1 5.1	30.4 13.4	29.9 29.0	28.9 33.1	28.7 33.4	28.9 25.3	27.6 12.7	23.4 2.7	19.7 0.4	162.5	10.8
Temperature (°C) Delhi Rainfall (cm)	29°N	219	14.42.5	16.7 1.5	23.3 1.3	30.0 1.0	33.3 1.8	33.3 7.4	30.0 19.3	29.4 17.8	28.9 11.9	25.6 1.3	19.4 0.2	15.6 1.0	67.0	18.9
Temperature (°C) Jodhpur Rainfall (cm)	26°18'N	224	16.80.5	19.2 0.6	26.6 0.3	29.8 0.3	33.3 1.0	33.9 3.1	31.3 10.8	29.0 13.1	20.1 5.7	27.0 0.8	20.1 0.2	14.9 0.2	36.6	19.0
Temperature (°C) Chennai Rainfall (cm)	13°4'N	7	24.54.6	25.7 1.3	27.7 1.3	30.4 1.8	33.0 3.8	32.5 4.5	31.0 8.7	30.2 11.3	29.8 11.9	28.0 30.6	25.9 35.0.	24.7 13.9	128.6	8.5
Temperature (°C) Nagpur Rainfall (cm)	21°9'N	312	24.51.1	23.9 2.3	28.3 1.7	32.7 1.6	35.5 2.1	32.0 22.2	27.7 37.6	27.3 28.6	27.9 18.5	26.7 5.5	23.1 2.0	20.7 1.0	124.2	14.8
Temperature (°C) Shillong Rainfall (cm)	24°.34'N	1461	9.81.4	11.3 2.9	15.9 5.6	18.5 14.6	19.2 29.5	20.5 47.6	21.1 35.6	20.9 34.3	20.0 30.2	17.2 18.8	13.3 3.8	10.4 0.6	225.3	11.3
Temperature (°C) Thiruvananthaputam Rainfall (cm)	8°29'N	61	26.723	27.3 2.1	28.3 3.7	28.7 10.6	28.6 20.8	26.6 35.6	26.2 22.3	26.2 14.6	26.5 13.8	26.7 27.3	26.6 20.6	26.5 7.5	181.2	2.5
Temperature (°C) Leh Rainfall (cm)	34°N	3506	–8.51.0	–7.2 0.8	–0.6 0.8	6.1 0.5	10.0 0.5	14.4 0.5	17.2 1.3	16.1 1.3	12.2 0.8	6.1 0.5	0.0	–5.6 0.5	8.5	25.7

Ans. (a) Two rainiest stations are Shillong (225.3 cm) and Mumbai (183.4 cm)

(b) Leh (34°N) is the farthest from the equator.

(c) Leh has the highest range of temperature (25.7°C)

Q.13. Study the climate data below and answer the questions. **(CBSE 2010)**

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp in Celcius	14.0	15.5	24.1	32	33	33.6	30.2	28.6	27.5	25.1	18.1	15.2
Rainfall in cm	2.5	2	2	2.5	2.7	7.5	19.1	17.8	14.5	2.5	1.5	1.5

(a) Name the rainiest month of the year. What is the reading?

(b) What is meant by annual range of temperature?

(c) Which two months have the least rainfall?

Ans. (a) The rainiest month of the year is July (19.1 cm)

(b) Annual range of temperature = Maximum temperature – minimum temperature (in a year)

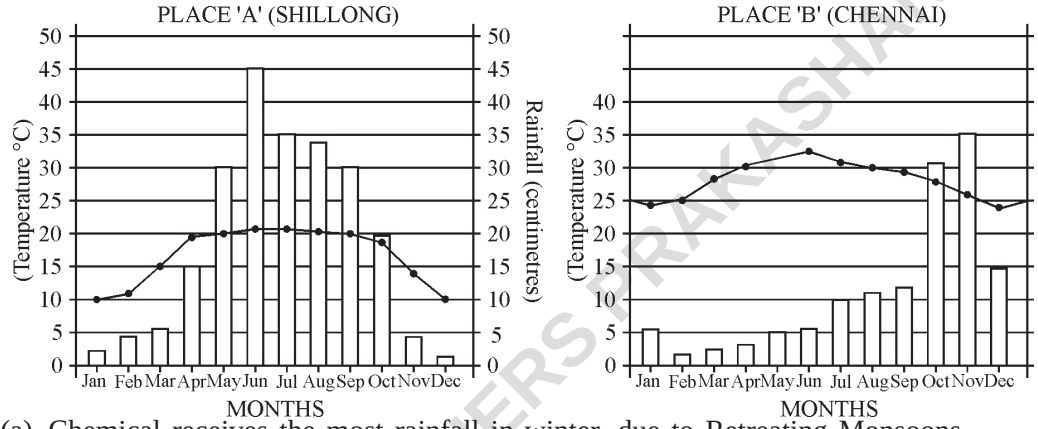
(c) November (1.5 cm) and December (1.5 cm) have the least rainfall.

Q.14. Study the climatic conditions of the two places and answer the following : (CBSE 2010)

(a) Name the place which receives the most rainfall in winter season and give reason for it.

(b) Name the place which receives maximum rainfall and how much?

(c) Name the place which has the lower range of temperature and how much.



Ans. (a) Chemical receives the most rainfall in winter, due to Retreating Monsoons.

(b) Shillong receives the maximum rainfall.

Toral rainfall received in Shillong = 2 + 4 + 6 + 15 + 30 + 45 + 36 + 34 + 30 + 19 + 5 + 1 = 227 cm (approx)

(c) Range of temperature at Shillong = 20 – 10 = 10°C Range of temperature at Chennai = 33 – 24 = 9°C Hence, Chennai has a lower range of temperature.

Q.15. Study the climate data of the given place and answer the following questions (CBSE 2010)

Months	Temperature in °C	Rainfall in mm
Jan.	20.5	7
Feb.	22.7	9
March	25.2	11
April	27.1	45
May	26.7	107
June	24.1	71
July	28.0	111
Aug.	23.0	137
Sep.	23.1	164
Oct.	22.9	153
Nov.	18.9	61
Dec.	20.2	13
Annual Rainfall		**889**

(a) Find out the annual range of temperature of the given place.

(b) Name the rainiest month.

(c) Which month receives the least rainfall and how much ?

Ans. (a) Annual range of temperature = 28.0 – 18.9 = 9.1°C

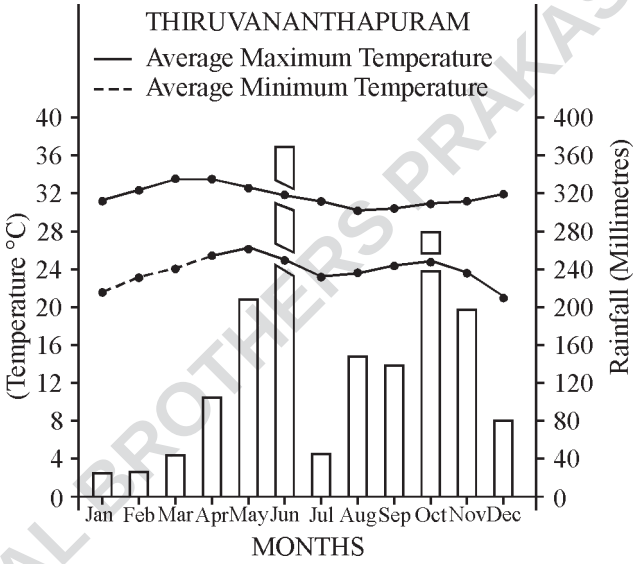
(b) September is the rainiest month.

(c) January receives the least rainfall (7 mm).

Q.16. What is the difference between weather and climate ? What kind of a climate does India have and why? (CBSE 2010)

Ans. Weather refers to the state of the atmosphere over an area at any point of time whereas climate refers to the sum total of weather conditions and variations over a large area for a long period of time. India has 'monsoon' type of climate. The climate of India is strongly influenced by monsoon winds.

Q. 17.



Study the climatic condition of Thiruvananthapuram and answer the following questions : **(CBSE 2010)**

(a) Which two months receive the lowest rainfall?

(b) What is the range of temperature in the month of June?

(c) Which month receives the highest rainfall?

Ans. (a) January and February receive the lowest rainfall.

(b) Range of temperature in June = 31 – 24 = 7°C

(c) The month of June receives the highest rainfall.

Q.18. What is ITCZ? What is its significance? (CBSE 2010)

Ans. It is Inter-Tropical Convergence Zone. This is the equatorial trough normally positioned about 5°N of the equator, also known as the monsoon trough during the monsoon season.

Q.19. Study the data given below carefully and answer the following questions. [2011 (T-2)]

Station	Latitude	Mean Monthly Temperature (in °C)		Average Annual Rainfall (in mm)
		Coldest month	Hottest Month	
Delhi	29° N	14.4 (Jan)	33.3 (May)	670
Jodhpur	26° 18′ N	14.9 (Dec)	33.9 (June)	366
Nagpur	21° 9′ N	20.7 (Dec)	35.5 (May)	1242

(19.1) Name the station which is farthest from the Equator.

(19.2) Name the driest and wettest station among the three stations.

Ans. (19.1) Delhi (29° N)

(19.2) Nagpur (1242 mm) wettest station. Jodhpur (33.9 – 14.9 = 19°C) driest station.

Q.20. Study the following climatic data and answer the questions that follow : **[2011 (T-2)]**

MONTHS	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
Temperature (in °C)	19.6	22.0	27.1	30.1	30.4	29.9	28.9	28.7	28.9	27.6	23.4	19.7
Rainfall (in cm)	1.2	2.8	3.4	5.1	13.4	29.0	33.1	33.4	25.3	12.7	2.7	0.4

(19.1) Name the rainiest month of the year. How much is the rainfall in this month?

(19.2) What is the annual range of temperature here?

(19.3) Name the hottest month and write the temperature.

Ans. (19.1) August is the rainiest month of the year. In August rainfall is 33.4 cm.

(19.2) Temperature 30.4° – 19.6 = 10.8°C

(19.3) May is the hottest month of the year (30.4°C)

Q.21. Why do western Ghats receive more rainfall than the Eastern Ghats. Explain briefly. [2011 (T-2)]

Ans. In terms of relief the western Ghats are much higher (900 – 1600 meter) in comparison to the Eastern Ghats (600 meter). The Western Ghats are continuous stretches of high mountains. Therefore, when the moisture ladden Arabian Sea branch of Southwest Monsoon first strikes the Western Ghats it brings heavy rainfall along the windward side of the Western Ghats. In Eastern Ghats, rainbearing winds of Southwest Monsoon do not face such orographic barrier and hence receive much lower amount of rainfall.

Q.22. What are western disturbances? How do they effect the climate of India? [2011 (T-2)]

Ans. The western cyclonic disturbances are weather phenomena of the winter months brought in by the westerly flow from the Mediterranean region. This phenomena usually influence the weather conditions of North and Northwestern regions of India. Tropical cyclones occur during October-November as a consequence of this western disturbances.

A characteristic feature of the cold weather season over the northern plains is the inflow of cyclonic disturbances from the west and the Northwest. These low pressure systems originate over the Mediterranean Sea and Western Asia and move into India along with the westerly flow. Under its influence cause the much needed rainfall over the plains and snowfalls in the mountains. The total amount of winter rainfall, locally known as **Mahawat,** is small but they are of immense value for the cultivation of rabi crops.

Q.23. Explain how monsoon acts as a unifying bond in the country. [2011 (T-2)]

OR

Why are the monsoons considered as a unifying bond? Explain.

OR

How do monsoon acts as a unifying bond for India? Explain.

Ans. The unifying influence of the monsoon on the Indian subcontinent is felt through its seasonal alternation of the wind systems and the associated weather conditions. It is also perceptible through uncertainties and uneven distribution of monsoon rainfall. The Indian landscape, its flora and fauna, agricultural seasons, livelihood of the people including festivals etc. are governed by the monsoon. Year after year people anxiously wait for the arrival of monsoon. The river valleys which carry monsoon water also unite the country as a single river valley unit.

Q.24. Define monsoon. Differentiate between 'Burst of the Monsoon' and 'Break of the Monsoon. [2011 (T-2)]

Ans. The word 'monsoon' is derived from the Arabic word 'mausim' which means season. It is basically a seasonal rain bearing winds, lasting for 100 – 120 days from early June to mid-September.

At the time of its arrival, the normal rainfall increases suddenly and continues constantly for several days. This is known as **'burst of the monsoon'.** The phenomenon can be distinguished from the pre-monsoon showers.

Another phenomenon associated with the monsoon is its tendency to have breaks in rainfall. The monsoon rains take place only for a few days at a time. They are interspersed with rainless intervals. These **breaks in monsoon** are related to the movement of the monsoon trough.

D. LONG ANSWER TYPE QUESTIONS (4 MARKS)

Q.1. Write a brief note on the south-west monsoon and its influence on the climate of India. (Important)

Ans. The word 'monsoon' is derived from the Arabic word 'mausim' which means season. It is marked by complete reversal of wind system according to seasons. The summer period is marked by the south-west monsons.

The low pressure centre over northern India intensifies by early June. It attracts the southeasterly trade winds from the Southern Hemisphere which become south-westerly winds after crossing the equator due to the coriolis effect. As they originate over warm sub-tropical areas of Southern Oceans they bring abundant moisture to India's mainland as southwest monsoon. The southwest monsoon strikes the southern parts of the peninsula in early June and by mid-July has its sway over entire India. The duration of the monsoon is between 100-120 days from early June to mid-September. This period is known as the Rainy Season. The two branches of southwest monsoons – the Arabian Sea branch and the Bay of Bengal branch–advance through the country and merge over the Northern Plains. They provide heavy torrential rainfall in the West Coast and Northeastern states. Even

Rajasthan receives some amout of rain. The bulk of the rainfall in India (75% to 90%) is caused by the advancing southwest monsoons and is concentrated within the Rainy Season. India has hot, wet tropical monsoon climate on account of it. The south-west monsoon is pulsating in nature marked by wet spells followed by dry spells termed as 'breaks'. The south-west monsoons are uncertain and variable in nature. They may cause floods in some parts and droughts in other parts. The entire climatic regime of India is dependant upon the south-west monsoons.

Q.2. Why does the rainfall decrease from east to west in Northern India? Write a brief note explaining why. (Important)

Ans. The bulk of rainfall in India comes from the southwest monsoons. The Arabian Sea branch of south-west monsoon approaches from the western side of the peninsula and moves in a southwesterly direction and reaches the Northern Plains by first week of July.

The Bay of Bengal branch of southwest monsoon brings heavy rainfall to the northeastern states. It arrives in Assam in the first week of June. The lofty mountains of the Purvanchals causes the monsoon winds to deflect towards the west over the Ganga Plains.

They cause heavy rainfall on the eastern parts of the Northern Plains as the moisture content of the onshore winds are high. As the winds move westwards their moisture content decreases and bence, the rainfall decreases.

The Arabian Sea branch of monsoons approach the Northern Plains from the west. But the highlands, the Aravalis, in the western part of the country, lie parallel to the direction of the onshore winds. Hence, very less or no rainfall is experienced in the western limits of the plains. They provide more rainfall on the central and eastern parts of the plains when the rain bearing winds strike the Himalayas.

Both the branches merge over the northwestern part of the Ganga Plains. Delhi receives its showers from either of the branches. The location of the monsoon trough over the Northern Plains also determines the amount of rainfall. When the axis of the trough lies over the plains, rainfall is good in these parts, especially in the eastern parts where tropical depressions from Bay of Bengal approach. When the monsoon trough moves northwards towards Himalayas, there are dry spells over the Northern Plains and heavy rainfall occurs in the Himalayas.

Hence, due to the above reasons, rainfall decreases from east to west in Northern India.

Q.3. Distinguish between southwest monsoon and northeast monsoon. (CBSE 2010)

Ans. The monsoon type of climate is marked by complete reversal of wind system according to seasons. The summer period is marked by the southwest monsoons while the winter period is marked by northeast monsoons. The points of difference between them are as follows :

(a) The southwest monsoons blow in a southwesterly direction to the mainland of India from June to September. While, the northwest monsoons blow in a northeasterly direction across India from mid-November to February.

(b) The southwest monsoons are seasonal winds influenced by differential heating of land and water. The southeasterly trade winds are attracted by low pressure over northern India. They are deflected to southwest after crossing the equator due to the Coriolis force while the northeast monsoons are the northeasterly trade winds.

(c) The southwest monsoons are onshore winds as they blow from the Indian Ocean as Arabian Sea and Bay of Bengal branches to land areas. Hence, they are moisture laden winds and bring heavy rainfall. While the northeast monsoons are offshore winds as they blow from land to sea. As a result they are mostly devoid of moisture.

(d) The southwest monsoons are responsible for the bulk of the rainfall in India (75% to 90%). They make Mawsynram in Meghalaya the rainiest station in the world. During the northeast monsoons some rainfall is brought by occassional western disturbances in north India. The northeast monsoons provide some rainfall in eastern coastal plain of Tamil Nadu after passing over Bay of Bengal.

(e) The southwest monsoons are warm winds. While the northeast monsoons are cold winds.

Q.4. Explain the major factors influencing climate in India.

Ans. The important factors that influence the climate of India can be identified as follows :

(a) **Latitudinal Location.** India lies in the Northern Hemisphere with the Tropic of Cancer (23°30′N) passing almost through the middle of India. Areas to its south have tropical type of climate, while areas to its north have characteristics of sub-tropical climate.

(b) **Altitude and Relief Features.** The mountainous areas to the north of the Himalayas have average altitude of upto 6000 metres. Stations located here are cool even in summer and receive snowfall during winter. The lofty Himalayas along the northern borders of India act as a mighty barrier protecting India from the cold winds from Central Asia in winter. As a result India experiences milder winters as compared to Central Asia. It also concentrates the monsoon rains within the mainland of India. The compact physical setting of India with the mountains in the north and Indian Ocean to the south of the peninsula, lends a broad common climatic framework to India.

(c) **Pressure and Winds.** The pressure and wind conditions over India are unique. They result in seasonal reversal of the wind system and monsoon winds dominate the climate of India. The bulk of the rainfall in the country is brought by the southwest monsoons.

Upper air circulation and the position of jet streams in upper troposphere influence the monsoons. Western cyclonic disturbances in winter and tropical cyclones during retreating monsoon season bring rainfall and affect the climate.

(d) **Distance from the sea.** Places at coastal locations, e.g. Mumbai, Chennai, Kolkata, have maritime or equable climate due to the moderating influence of the sea. But places in the interior of the country, far from the sea, experience extreme climate due to continentality, e.g. Dehli.

Q.5. Write briefly about the Arabian Sea branch of the monsoon. (Important)

Ans. The Indian Peninsula divides the southwest advancing monsoons into two branches – the Arabian Sea branch and the Bay of Bengal branch. The Arabian Sea branch of monsoons approaches the western coast of India from the Arabian Sea in a southwesterly direction. It arrives at Thiruvananthapuram on the 1st of June. By 10th of June it reaches Mumbai. The onshore moisture laden winds strike the Western Ghats and provide heavy rainfall on its windward side. As a result Mumbai in the windward side receives much more rainfall than Pune which is located on the leeward side of the Western Ghats.

The Deccan Plateau lies in the rainshadow area and hence receives less rainfall.

By mid-June the Arabian Sea branch of the monsoon arrives over Saurashtra-Kuchchh and the central part of the country.

In the western and northwestern parts of the country, the highlands, the Aravalis, lie parallel to the direction of the incoming Arabian Sea branch of monsoons. Hence, these areas do not receive much rainfall because the rainbearing winds do not strike any barrier.

By the first week of July, western Uttar Pradesh, Punjab, Haryana and eastern Rajasthan experience the monsoons.

The Arabian Sea branch of monsoons merges with the Bay of Bengal branch over the northwestern part of the Ganga plains. Delhi receives its rain from either of the two branches.

Q.6. Write in brief about the mechanism of the monsoons. (Important)

OR

What is meant by the term 'monsoon'? Give the main characteristics of monsoons. (CBSE 2010)

Ans. The mechanism of monsoons can be explained by the following facts :

(a) The differential heating and cooling of land and water creates low pressure on the landmass in summer which attracts moisture-bearing winds from the high pressure centres over the sea.

(b) The shift of the position of Inter – Tropical Convergence Zone (ITCZ) in summer, over the Ganga plain from the equatorial region, creates a monsoon trough that attracts winds. The shifting of the axis of the trough effects the duration and intensity of monsoons.

(c) The movement of the westerly jetstream to the north of the Himalayas and the presence of the tropical easterly jetstream over Indian Peninsula during summer bring in the tropical depressions and cyclones associated with monsoons.

(d) The intensity and position of the high pressure area east of Madagascar, approximately at 20°S over the Indian Oceans, affects Indian monsoon.

(e) The Tibetan plateau gets intensely heated during summer, which results in strong vertical air currents. High pressure is formed over the plateau at about 9 km above sea level.

Periodic change in pressure conditions over southern oceans, known as Southern Oscillation and effect of El Nino also influences the monsoons.

Q.7. Write a brief account of the conditions and characteristics of the retreating monsoons.

Ans. The months of October-November mark a period of transition from hot rainy season to cold dry winter conditions. With the apparent movement of the sun southwards, the low pressure monsoon trough over the Northern Plains weakens and is gradually replaced by a high pressure system. The low pressure conditions shift to the Bay of Bengal.

As a result, the southwest monsoon winds weaken and start withdrawing gradually from India. By the beginning of October it withdraws from the Northern Plains. This period is known as the Retreating Monsoon or Transition season because the monsoons withdraw or retreat from India. The Retreating Monsoon season is marked by clear skies and rise in temperature. While days are warm, nights are cool and pleasant. High rate of evaporation from the land that is still

moist results in high humidity and oppressive weather conditions during the day. This phenomenon is known as 'October heat'.

With the shift of low pressure zone to over the Bay of Bengal in early November, cyclonic depressions originating over the Andaman Sea moves over the Eastern Coast. The tropical cyclones and associated heavy rainfall cause heavy destruction in the thickly populated deltaic areas of Tamil Nadu and Andhra Pradesh and sometimes Orissa, West Bengal and Bangladesh.

The bulk of the rainfall of the Coromandel coast is derived from these cyclones and depressions. The retreat or withdrawl of monsoon is a gradual process and takes a long time.

Q.8. Describe how the Himalayas affect the climate of India.

Ans. The lofty Himalayas stand as a mighty barrier along the entire northern boundary of India. They have a profound influence on India's climate. The high mountains with an elevation of 6000 metres act as an effective climatic divide. In winter they prevent the cold winds from Central Asia from entering India. As a result, India experiences comparatively milder winters as compared to Central Asia.

The mountain wall blocks the monsoon winds, preventing their escape out of India. It concentrates rainfall from the monsoon winds within India.

When the moisture laden monsoon winds strike the Himalayas, heavy rainfall is caused in the foothills region. The Northern Plains of India receive rainfall from the Bay of Bengal branch of monsoons becaused the eastern mountains deflect these winds over the Ganga Plains.

The Himalayas are responsible for giving the subtopical areas in northern India a touch of the tropical climate with hot, wet summer and mildly cold, dry winters. The alignment of the Himalayas also influences climate, So Ladakh on the leeward side of the Himalayas is a cold desert while Mawsynram on the southern ranges of Purvanchal receives the highest rainfall in the world.

Q.9. Give an account of the weather condition and characteristics of the cold season.

Ans. The period between mid-November to February is the cold weather season in India. December and January are the coldest months in the northern part of India. The cold weather season is characterised by the following features :

(a) A high pressure region develops in the northern part of the country with the apparent movement of the sun southwards.

(b) The northeast trade winds prevail over the country. As they blow from land to sea, for most parts of the country it is a dry season.

(c) Light winds move outwards from the high pressure area. Under the influence of relief, these winds blow from the west and northwest in the Ganga Valley.

(d) Days are warm and nights are cool during the season. Weather is marked by clear sky, low temperature and low humidity and feeble variable winds mainly in the north.

(e) Temperature is lower in the northern parts, ranging between 10° to 15°C. Temperature is higher in southern India, between 24° to 25°C, as in Chennai.

(f) Frost is common in northern parts.

(g) The higher slopes of the Himalayas, e.g. places like Srinagar, Leh and Shimla, experience snowfall.

(h) The western cyclonic disturbances are characteristic weather phenomena of the winter months. Their inflow from the west and northwest is brought in by the westerly flow from the Mediterranean Sea region. They cause the much needed winter rains over the plains and snowfall in the mountains in the northwestern India.

(i) The peninsular region does not have a well-defined cold season due to moderating influence of the sea. Rainfall occurs on Tamil Nadu coast during winter because the northeast winds blow from sea to land here.

Q.10. Give a brief account of the hot weather season in India. (Important)

Ans. The period between April to June is the hot weather season or summer in India.

The characteristic features of the hot weather season are as follows :

(a) The global heat belt shifts northward due to the apparent northward movement of the sun.

(b) The temperature recordings taken during April to June of stations at different latitudes, show the influence of the shifting of the heat belts. In March temperature in Deccan is about 38°C. In April, temperatures in Madhya Pradesh and Gujarat are around 42°C. In May, temperature of 45°C is common in northwestern India. Peninsular India has moderate temperature due to influence of sea.

(c) The rising temperatures lead to fall in air pressure in the northern parts. Toward the end of May, an elongated low pressure area develops in the north extending from the Thar desert in the northwest to Patna and Chhota Nagpur platean in the east.

(d) Strong, gusty, hot, dry winds, locally called 'loo' blow during the afternoon over north and northwestern India. They may continue till late evening.

(e) Duststorms are common during May in Punjab, Haryana, Delhi, Eastern Rajasthan and Western Uttar Pradesh. Sometimes they bring light rain and pleasant cool breeze that provide temporary relief from the heat.

(f) High temperature during the day causes violent, localised thunderstorms by the evening. These thunderstroms are associated with violent winds and torrential downpour, often accompanied with rain. They are known as 'Kal Baisakhi' or calamity of the month of Baisakh in West Bengal.

(g) In late May pre-monsoon showers occur, especially in Karnataka and Kerala. They are known as mango showers as they help in the early ripening of mangoes.

E. MAP WORK (4 MARKS)

Q.1. On the outline map of India, mark and label the areas that receives seasonal rainfall from June to September.

(a) Less than 20 cm 

(b) 40-60 cm 

(c) 100-200 cm 

(d) Above 400 cm 

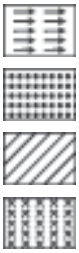
Q.2. On an outline map of India, mark and label the following:

(a) Direction of the south-west monsoons with arrows

(b) The places that receive annual rainfall above 200 cm

(c) The places that receive annual rainfall below 40 cm

(d) The places that receive annual rainfall of 60-100 cm



Q.3. On the outline map of India below, mark and label the following:

(a) Places that receive snowfall in winter

(b) The north-east monsoon with arrows

(c) The place that receives the highest rainfall in the world

(d) The coast of South India that receives high rainfall in winter

II. FORMATIVE ASSESSMENT

I. PROJECT WORK

Make a rain gauge and calculate the rainfall in your locality for the month.

Requirement :

1. A large mouth jar with straight sides 2. Ruler 3. Paper and pens 4. Rainy days

Procedures :

1. Tape the ruler to the outside of the jar and place the jar outside when it rains.
2. Bring in the jar when the rain stops and note the label of the rainfall in the jar.
3. Make a chart to track the rain level each day. You can plot a graph.
   (Mark inches on one side of the chart and days of the week on the adjacent side of your chart paper.)

II. ACTIVITIES

Q.1. Labelling

In the following diagram label the following parts :

Leeward Slope, Windward Slope, Rainshadow Area, Mountain

Ans. A : Windward Slope B : Leeward Slope

C : Rainshadow Area D : Mountain

Q.2. Grouping

Given below are a list of some stations in India which receive rainfall during the monsoon season from either the Arabian Sea branch or Bay of Bengal branch of monsoon. Categorise them :

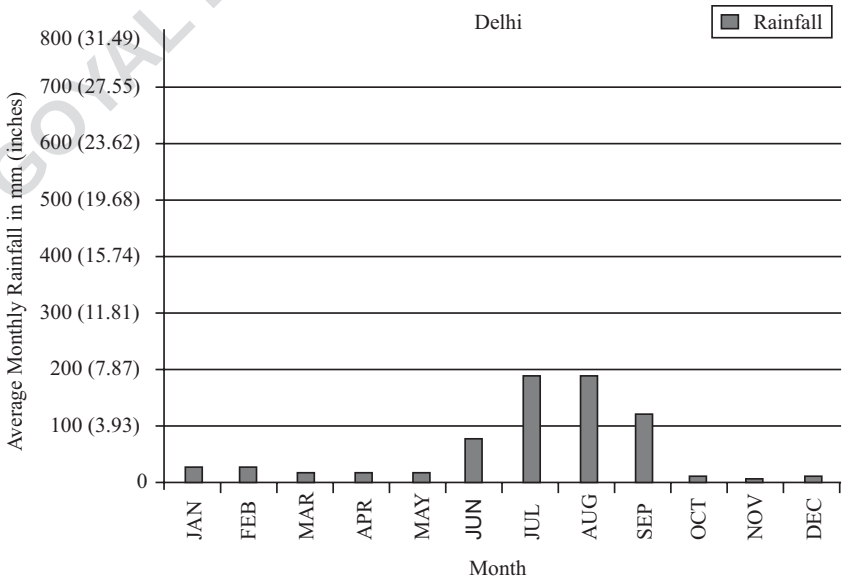
Vadodara (Saurashtra), Guwahati, Mumbai, Shillong, Thiruvananthapuram, Delhi, Kolkata, Mangalore, Bhubaneswar, Lucknow, Dehradun, Indore, Patna, Shimla, Kachchh, Mathura, Panaji, Mawsynram, Patiala, Allahabad.

Ans.

Arabian Sea branch	**Bay of Bengal branch**	**Either Arabian Sea branch or Bay of Bengal branch**
Vadodara (Saurashtra) Mumbai, Thiruvananthapuram, Mangalore, Indore, Kachchh, Panaji, Patiala	Guwahati, Shillong, Kolkata, Bhubaneswer, Patna, Mawsynram, Allahabad	Delhi, Lucknow, Dehradun, Shimla, Mathura

III. ASSIGNMENTS

Q.1. The following graph represents the annual rainfall in Delhi. Answer the questions that follow the graph.



(a) In which two months did Delhi receive the highest rainfall?
(b) In which month did Delhi receive the least rainfall?
(c) How much rainfall did Delhi receive in the month of September? Give the approximate answer in millimetres.
(d) Which month did the monsoon occur in Delhi and it lasted upto which month? Give reasons for your answer.
(e) Write in a few sentences describing Delhi's climatic pattern.

Ans. (a) July, August. **(b)** November. **(c)** 125 mm

(d) From June to September, Advancing Monsoon (Rainy Season) Rain from Bay of Bengal and Arabian Sea branch of southwest monsoon.

(e) Delhi has continental type of climatic pattern. Lowest temperature recorded in Dec-Jan goes down to 4°C while in Summer temperature is very high, reaching upto 44°C. The range of temperature is high because it is far from the sea. It receives rainfall during the Advancing Monsoon Season from both the Bay of Bengal branch and Arabian Sea branch of southwest monsoon. The rainy season continues from end of June to September in Delhi. In winter some rainfall comes from the western disturbances. Annual rainfall is 725 mm.

Q.2. The following pictures are from different climatic zones of India. Study the pictures and then fill in the chart given below the pictures :

A B C

	Houses	Clothes	Food	Occupation
A Plains	Houses made of mud with sloping roofs. Raised on stilts in rainier parts	Light cotton clothes.	Rice wheat dal, vegetables, fish, meat, milk.	Agriculture, fishing.
B Desert	Thick wall and flat roofs	Long cotton robes.	Chapati made of bajra, some vegetables, meat.	Pastoral nomadism, tourism.
C Mountain	Houses made of rocks or wood.	Thick woollen clothes.	Rice, wheat, potatoes, vegetables, fruits, meat, milk.	Animal rearing, terrace cultivation, tourism.

Q.3. Season Search

Given below are a list of characteristics and weather phenomena at different times of the year. Classify them according to the season in which it occurs. Complete the given table.

October heat, Western disturbances, Loo, Tropical cyclones along eastern coast, Burst of Monsoon, Kal Baisakhi, Mango Showers, Monsoon trough of low pressure, 'Breaks' in rainfall, Mahawat, Snowfall.

Cold weather season WINTER	Hot weather season SUMMER	Advancing monsoon RAINY SEASON	Retreating monsoon TRANSITION SEASON
mid-Nov / Dec – Feb	March – May	June – Sept	Oct – Nov
Western disturbances Snowfall. Mahawat.	Loo, Kal Baisakhi. Mango Showers.	Burst of Monsoon Monsoon trough of low pressure. Breaks in rainfall.	October heat. Tropical cyclones along eastern coast.

IV. GROUP DISCUSSION

Make a group among the students of your classroom and discuss India's water scarcity problems. Outline the characteristics of monsoon and its vagaries that may lead to water searching.

V. DEBATE

Divide the students of your classroom and debate on the advantage and disadvantage of dams across rivers.

VI. QUIZZES

Q.1. Write the names of the four seasons on the blackboard. Four students should take charge of the seasons, one for each season.

Take each season by turn and ask the students of the class to name some stations (places) that receive rainfall or snowfall during that season. The students in change of each season should write down the correct names of the stations in their respective columns.

Ans.

WINTER	SUMMER	RAINY SEASON	TRANSITION SEASON
Srinagar (snowfall) Shimla (snowfall) Places in Punjab, Haryana Plains, e.g. Bhatinda Chennai (Tamil Nadu Coast)	Delhi (duststorm) Kolkata, Guwahati, (Kal Baishaki) Kerala, Karnataka (mango showers) e.g. Mysore.	Thiruvananthapuram Mumbai, Shillong, Mawsynram, Kolkata, Delhi. Most of India.	Deltaic areas of Goda-vari, Krishna, Kaveri, e.g. Kakinada, Coromandel coast – Chennai

Q.2. Word Jumble :

Rearrange the letters in the following words to find the true meaning as shown by the hints in brackets :

(a) TEHAWRE *(Day-to-day state of the atmosphere)*

(b) UISMAM *(Arabic word from which the word 'Monsoon' is derived)*

(c) SNMRMWAYA *(This place gets the highest rainfall in the world)*

(d) LE ONNI *(Periodic warm ocean current along the coast of Peru that affects monsoon)*

(e) SICLOROI *(Force caused by the Earth's rotation)* CORIOLIS

Ans. (a) WEATHER **(b)** MAUSIM **(c)** MAWSYNRAM **(d)** EL NINO **(e)** CORIOLIS

Q.3. Missing Letters :

Find the missing letters in the following words with the help of the hints provided :

Ans. (a) LOO *(strong hot and dry wind blowing over North India in summer)*

(b) MANGO SHOWERS *(showers that helps ripening of mangoes in South India)*

(c) COROMANDEL *(southern coast of India that receives rainfall in winter)*

(d) TROPICAL CYCLONE *(strong destructive winds formed over the Bay of Bengal)*

(e) JETSTREAM *(narrow belt of high altitude winds in the troposphere)*