

3

Atmosphere and Climate

The Big Questions (Page no. 39)**1. What is the composition of the atmosphere?**

Ans. The atmosphere is a mixture of various gases, water vapour, and tiny dust particles. The gaseous composition is as follows:

- **Nitrogen (78%):** The most abundant gas, vital for plant survival.
- **Oxygen (21%):** Essential for the respiration of living beings.
- **Argon (0.93%):** An inert noble gas present in minor amounts.
- **Carbon Dioxide (0.04%):** A greenhouse gas that traps heat and is used by plants for photosynthesis.
- **Other Gases (0.03%):** Trace gases including helium, neon, krypton, xenon, ozone, and hydrogen.
- **Water Vapour:** Varies from 0.1% to 0.4% and is crucial for cloud formation and precipitation.

2. How do the different layers of the atmosphere affect the Earth?

Ans. Each of the five layers of the atmosphere affects Earth in distinct ways:

- **Troposphere:** It contains the air we breathe and almost all water vapour. It directly drives Earth's weather, hosting cloud formation, rain, fog, and wind.
- **Stratosphere:** It contains the critical ozone layer, which absorbs and shields Earth from the Sun's harmful ultraviolet (UV) radiation. Because it is free of weather disturbances, it also provides ideal conditions for flying commercial aeroplanes.
- **Mesosphere:** This layer acts as a planetary shield by burning up most meteorites that enter from space before they can strike the Earth's surface.
- **Thermosphere:** Contains the ionosphere, which reflects radio waves back to Earth, making global wireless telecommunication possible. It also hosts the beautiful auroras.
- **Exosphere:** The outermost boundary with extremely thin air, where light gases (hydrogen and helium) gradually merge and float into outer space.

3. What is the mechanism of monsoon?

Ans. The monsoon is caused by seasonal reversal of winds due to differences in temperature and pressure.

Process:

- In summer, land heats faster than sea
- This creates low pressure over land and high pressure over sea
- Winds blow from sea to land carrying moisture
- These winds bring heavy rainfall (South-West Monsoon)

In winter:

- Land cools faster → high pressure over land
- Winds blow from land to sea → dry winds (North-East Monsoon)

4. How can we reduce our carbon footprint?

Ans. A carbon footprint is the amount of carbon dioxide released into the atmosphere due to human activities.

Ways to reduce it:

- Save electricity (switch off unused appliances)
- Use public transport, cycle, or walk
- Reduce, reuse, recycle
- Use renewable energy (solar, wind)
- Plant more trees
- Avoid excessive use of fuels and plastics

LET'S RECALL

How is nitrogen useful for plants? Remember that you learnt this in the chapter 'The Invisible Living World: Beyond Our Naked Eyes', in your Grade 8 Science textbook.

Ans. Nitrogen is a very important nutrient for plants, but plants cannot use nitrogen directly from the air.

Uses of Nitrogen in Plants:

- **Helps in Growth:** Nitrogen is essential for the growth and development of plants.
- **Formation of Chlorophyll:** It helps plants make chlorophyll, which is needed for photosynthesis (making food).
- **Protein Formation:** Nitrogen is used to form proteins, which are necessary for plant cells.
- **Healthy Green Leaves:** Adequate nitrogen gives plants a green and healthy appearance.

How Plants Get Nitrogen:

- Nitrogen from the air is converted into usable form by nitrogen-fixing bacteria in the soil and roots (like in leguminous plants).
- Plants absorb nitrogen from the soil in the form of nitrates and nitrites.

THINK ABOUT IT

You might have noticed that sometimes the wind is so strong that it is difficult to walk against it. Can you think of some other times when strong winds have caused problems for you?

Ans. Yes, strong winds can cause many problems in our daily life. Some examples are:

- **Difficulty in walking or cycling:** Strong winds push against us and make movement difficult
- **Falling trees and branches:** Can block roads or cause injuries
- **Damage to houses and property:** Roofs, windows, and weak structures may get damaged
- **Umbrellas turning inside out:** Very common during storms
- **Dust storms and low visibility:** Makes it hard to see while walking or driving
- **Power cuts:** Strong winds can damage electric poles and wires

LET'S EXPLORE

Find out other categories of wind based on speed and their common effects, and share your findings in class.

Ans.

Wind Type	Speed (km/h)	Effects
• Gentle Breeze	- 12–19	- Flags flutter
• Moderate Breeze	- 20–38	- Dust blows
• Strong Gale	- 89–102	- Trees bend, walking becomes difficult
• Gale	- 50–88	- Trees sway, minor damage
• Violent Storm	- 103–117	- Trees uprooted, heavy damage
• Cyclone	- 118+	- Severe destruction

LET'S ANALYSE

Note down the weather report from a local newspaper for two weeks and observe the changes occurring in the weather.

Ans. After noting the weather report for two weeks, you may observe the following changes:

- **Temperature changes**
 - Some days are hotter, while others are cooler.
 - Day and night temperatures may vary.
- **Wind variations**
 - Wind speed may change from calm to strong breeze.
 - Wind direction may also vary.

- **Rainfall patterns**
 - Some days may have rainfall, while others remain dry.
 - The amount of rainfall can differ each day.
- **Humidity levels**
 - On rainy or cloudy days, humidity is higher.
 - On sunny days, the air may feel drier.
- **Cloud cover**
 - Some days are clear with no clouds.
 - Other days may be partly cloudy or overcast.

Conclusion: Weather changes day-to-day, showing that it is not constant. These variations help us understand the difference between weather (short-term changes) and climate (long-term patterns).

THINK ABOUT IT

Hindustani Classical music associates certain rāgas with specific seasons. Find out which rāgas are connected to each season with the help of your elders and teachers.

Ans.

Season	Associated Rāgas
• Spring (Vasant)	- Raga Basant, Raga Bahar
• Summer (Grishma)	- Raga Deepak
• Monsoon (Varsha)	- Raga Megh, Raga Miyan ki Malhar
• Autumn (Sharad)	- Raga Bhairav, Raga Durga
• Winter (Hemant / Shishir)	- Raga Malkauns, Raga Todi

LET'S EXPLORE

Describe in your own words how monsoon affects the lives of the people around you.

Ans. Monsoon has a big impact on the daily lives of people around us. It brings both benefits and challenges.

Positive Effects:

- Farmers depend on monsoon rains for growing crops like rice and vegetables.
- Water sources such as rivers, lakes, and wells get filled.
- The weather becomes cooler and more pleasant after hot summers.

Negative Effects:

- Heavy rains can cause flooding, damaging homes and roads.
- Waterlogging makes it difficult to travel and can delay school or work.
- Increased chances of diseases like cold, dengue, and malaria.
- Sometimes electricity and transport services are disrupted.

Daily Life Changes:

- People carry umbrellas or wear raincoats.
- Outdoor activities are reduced.
- Traffic jams and delays are more common.

LET'S EXPLORE

My Carbon Footprint

Step 1: My Daily Habits

Tick the options that best describe you.

A. Transport

- I usually walk/use a cycle. (Low impact)
- I use public transport/carpool. (Medium impact)
- I travel by private cars even for short distances. (High impact).

B. Electricity Use

- I always switch off electrical appliances (lights, fans, etc.) when not in use. (Low impact)
- I sometimes forget to switch off electrical appliances (lights, fans, etc.). (Medium impact)
- I leave electrical appliances (lights, fans, etc.) on frequently. (High impact)

C. Water Use

- I use water judiciously, for example, just one bucket of water for bathing. (Low impact)
- I sometimes waste water (leaving the tap running/ more buckets of water for a bath/long showers). (Medium impact)
- I rarely think about saving water. (High impact)

D. Waste and Plastics

- I reuse, recycle, and avoid single-use plastics. (Low impact)
- I sometimes use disposable plastics (bottles/bags/straws). (Medium impact)
- I often throw away plastic and do not recycle. (High impact)

Step 2: Score Yourself

- Low impact choices = 1 point
- Medium impact choices = 2 points
- High impact choices = 3 points
- Very high impact choices = 4 points
- Now add up your total score: points

Step 3: My Climate Action Pledge

- Think about two simple changes you can make to reduce your score, and write them down below.
1. _____
 2. _____

Ans.

My Carbon Footprint**Step 1: My Daily Habits (Example Choices)**

- A. Transport:** I use public transport/carpool. (Medium impact – 2 points)
- B. Electricity Use:** I sometimes forget to switch off appliances. (Medium impact – 2 points)
- C. Water Use:** I use water judiciously. (Low impact – 1 point)
- D. Waste and Plastics:** I sometimes use disposable plastics. (Medium impact – 2 points)

Step 2: Score Yourself

Total Score = 2 + 2 + 1 + 2 = 7 points

This means my carbon footprint is moderate, and I can improve it.

Step 3: My Climate Action Pledge

1. I will always switch off lights and fans when not in use.
2. I will avoid single-use plastics and carry reusable bags and bottles.

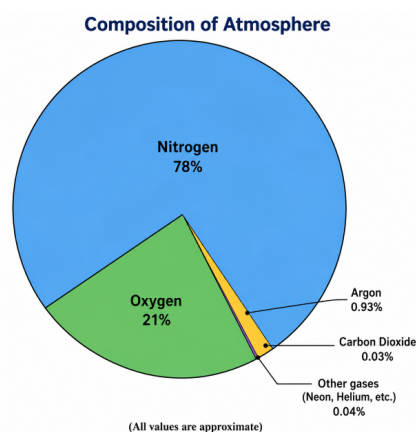
Questions and activities

1. What is atmosphere? Explain its composition with the help of a pie diagram.

Ans. Atmosphere is the blanket of gases that surrounds the Earth.

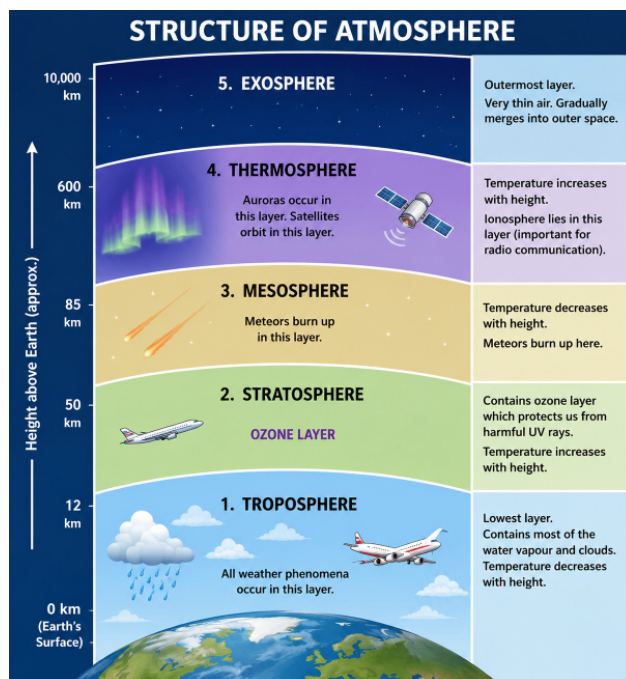
Composition of Atmosphere:

- Nitrogen – 78%
- Oxygen – 21%
- Argon – 0.93%
- Carbon dioxide – 0.03%
- Other gases (neon, helium, etc.) – very small amounts



2. Draw a labelled diagram of the structure of atmosphere.

Ans.



3. Which are the four main seasons of India?

Ans. India experiences four main seasons due to changes in temperature, pressure, and wind patterns. These are:

- **Summer Season (March to May):** This season is characterized by high temperatures and dry weather. In many parts of India, hot winds called loo blow during this time.
- **Monsoon Season (June to September):** This is the rainy season, when the south-west monsoon winds bring heavy rainfall to most parts of the country.
- **Autumn Season (October to November):** Also known as the retreating monsoon season, the weather becomes clearer and cooler as the monsoon winds withdraw.
- **Winter Season (December to February):** This season is marked by low temperatures, especially in northern India. Some regions also receive light rainfall.

4. Why do you not feel the pressure of the atmosphere?

Ans. We do not feel the pressure of the atmosphere because:

- **Balanced internal pressure:** The air inside your body (in lungs, blood, and tissues) pushes outward with almost the same force as the atmospheric pressure pushing inward. This balance cancels out the effect.
- **Adaptation:** Our bodies are naturally adapted to live under atmospheric pressure, so we don't notice it in normal conditions.
- **Pressure acts equally in all directions:** Atmospheric pressure presses from all sides equally, so there is no unbalanced force to make you feel it.

5. In which layer of the atmosphere do aeroplanes fly and why?

Ans. Aeroplanes fly in the stratosphere because:

- **Stable weather:** The stratosphere has very little disturbance—no clouds, storms, or turbulence like in the troposphere.
- **Smooth flying conditions:** This makes flights more comfortable and safer.
- **Less air resistance:** The air is thinner, so aeroplanes can fly faster and use less fuel.

Therefore, flying in the stratosphere helps aeroplanes travel smoothly, safely, and efficiently.

6. Distinguish between the following:**a. The troposphere and stratosphere****Ans.**

Troposphere	Stratosphere
1. It is the lowest layer of the atmosphere. 2. It extends up to about 12 km height. 3. All weather phenomena like rainfall and storms occur here. 4. Temperature decreases with increase in height. 5. Contains most of the water vapour and clouds.	1. It lies above the troposphere. 2. It extends up to about 50 km height. 3. It is free from weather disturbances. 4. Temperature increases with increase in height. 5. Contains the ozone layer that protects Earth from UV rays.

b. The south-west monsoon and north-east monsoon**Ans.**

South-West Monsoon	North-East Monsoon
1. It occurs from June to September. 2. Winds blow from sea towards land. 3. It brings heavy rainfall to most parts of India. 4. It is also called the rainy season of India.	1. It occurs from October to December. 2. Winds blow from land towards sea. 3. It gives rainfall mainly to the Tamil Nadu coast. 4. It is also called the retreating monsoon.

7. Do it yourself: Table 3.3 shows the average the monthly temperatures and rainfall amounts for 10 representatives stations. Study these figures on you own and convert them into 'temperature and rainfall' graphs. The visual representations will help you grasp their similarities and differences at a glance. One such graph (Fig. 3.14) is already prepared for you. See if you can arrive at some broad generalisations about our diverse climate conditions.

7.1 Now look at Table 3.3 again. Re-arrange the 10 stations according to their distance from the equator.

Ans. Closest to equator → farthest

- | | |
|-------------------------------|-----------------------|
| • Thiruvananthapuram (8°29'N) | • Bengaluru (12°58'N) |
| • Chennai (13°4'N) | • Mumbai (19°N) |
| • Nagpur (21°9'N) | • Kolkata (22°34'N) |
| • Shillong (24°34'N) | • Jodhpur (26°18'N) |
| • Delhi (29°N) | • Leh (34°N) |

7.2 Find out:**a. Two stations with the most extreme climate.****ans.** Delhi, Leh

They have very hot summers and cold winters (high temperature variation).

b. Two stations influenced by retreating monsoons.**Ans.** Chennai, Thiruvananthapuram

These places receive rainfall mainly during October–November.

c. The two hottest stations in the month of**(i) February****(ii) June****Ans.****(i) February:** Mumbai, Chennai**(ii) June:** Nagpur, Jodhpur

7.3 Now find out:**a. Why does Shillong experience more rainfall than Kolkata?**

Ans. Shillong receives more rainfall than Kolkata because it is located on the Meghalaya Plateau (hilly region). The moisture-laden monsoon winds from the Bay of Bengal are forced to rise when they strike these hills, causing heavy orographic rainfall.

b. Why does Delhi receive more rainfall than Jodhpur?

Ans. Delhi receives more rainfall than Jodhpur because it lies closer to the path of the moist monsoon winds. On the other hand, Jodhpur is located in the Thar Desert, where the winds lose most of their moisture before reaching, resulting in less rainfall.

Stations	Latitude	Altitude (Metres)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Rainfall
Temperature (°C) Bengaluru	12°58'N	909	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 (cm)			0.7	0.9	1.1	4.5	10.7	7.1	11.1	13.7	16.4	15.3	6.1	1.3	88.9
Temperature (°C) Mumbai	19°N	11	24.4	24.4	26.7	28.3	30.0	28.9	27.2	27.2	27.2	27.8	27.2	25.0	
Rainfall (cm)			0.2	0.2	-	-	1.8	50.6	61.0	36.9	26.9	4.8	1.0	-	183.4
Temperature (°C) Kolkata	22°34'N	6	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 (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	162.5
Temperature (°C) Delhi	29°N	219	14.4	16.7	23.3	30.0	33.3	33.3	30.0	29.4	28.9	25.6	19.4	15.6	
Rainfall (cm)			2.5	1.5	1.3	1.0	1.8	7.4	19.3	17.8	11.9	1.3	0.2	1.0	67.0
Temperature (°C) Jodhpur	26°18'N	224	16.8	19.2	26.6	29.8	33.3	33.9	31.3	29.0	20.1	27.0	20.1	14.9	
Rainfall			0.5	0.6	0.3	0.3	1.0	3.1	10.8	13.1	5.7	0.8	0.2	0.2	36.6
Temperature (°C) Chennai	13°4'N	7	24.5	25.7	27.7	30.4	33.0	32.5	31.0	30.2	29.8	28.0	25.9	24.7	
Rainfall (cm)			4.6	1.3	1.3	1.8	3.8	4.5	8.7	11.3	11.9	30.6	35.0	13.9	128.6
Temperature (°C) Nagpur	21°9'N	312	21.5	23.9	28.3	32.7	35.5	32.0	27.7	27.3	27.9	26.7	23.1	20.7	
Rainfall (cm)			1.1	2.3	1.7	1.6	2.1	22.2	37.6	28.6	18.5	5.5	2.0	1.0	124.2
Temperature (°C) Shillong	24°34'N	1461	9.8	11.3	15.9	18.5	19.2	20.5	21.1	20.9	20.0	17.2	13.3	10.4	
Rainfall (cm)			1.4	2.9	5.6	14.6	29.5	47.6	35.9	34.3	30.2	18.8	3.8	0.6	225.3
Temperature (°C) Thiruvananthapuram	8°29'N	61	26.7	27.3	28.3	28.7	28.6	26.6	26.2	26.2	26.5	26.7	26.6	26.5	
Rainfall (cm)			2.3	2.1	3.7	10.6	20.8	35.6	22.3	14.6	13.8	27.3	20.6	7.5	181.2
Temperature (°C) Leh	34°N	3506	-8.5	-7.2	-0.6	6.1	10.0	14.4	17.2	16.1	12.2	6.1	0.0	-5.6	
Rainfall (cm)			1.0	0.8	0.8	0.5	0.5	0.5	1.3	1.3	0.8	0.5	-	0.5	8.5

7.4 Now think why**a. Thiruvananthapuram has an equable climate?**

Ans. Thiruvananthapuram is located near the sea (coastal area). The sea has a moderating effect on temperature, preventing extreme heat or cold. As a result, the temperature remains fairly constant throughout the year.

b. Chennai has more rainfall only after the fury of the monsoon is over in most parts of the country?

Ans. Chennai receives most of its rainfall from the retreating (north-east) monsoon winds during October and November, after the south-west monsoon has withdrawn from most parts of India.

c. Leh has moderate precipitation almost throughout the year?

Ans. Leh is located in a rain shadow region of the Himalayas. The mountains block the moisture-laden monsoon winds, so it receives very little rainfall and only light precipitation throughout the year.

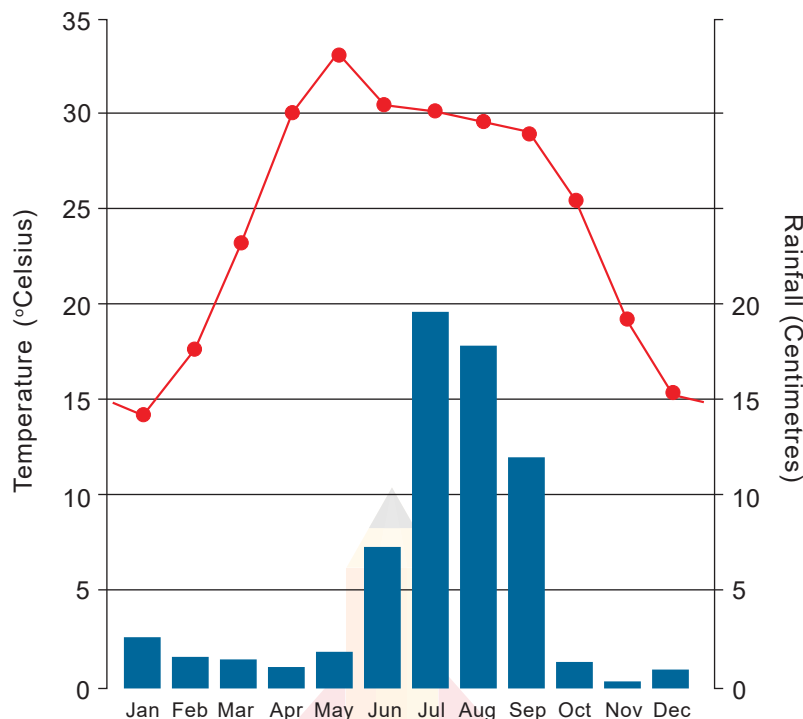


Fig. 3.14. Temperature and Rainfall of Delhi

7.5 Despite these differences across regions, can you observe any substantial evidence to conclude that the monsoons provide a very strong framework, lending overall climatic unity to the whole country?

Ans. Yes, despite regional differences, there is strong evidence that the monsoon provides climatic unity to the whole country:

- The seasonal reversal of winds (monsoon winds) affects almost all parts of India.
- Most regions receive rainfall during the same monsoon period (June to September).
- The agricultural cycle across the country depends on the arrival and withdrawal of the monsoon.
- Festivals, lifestyle, and economic activities are closely linked to the monsoon season.
- Even areas with less rainfall (like deserts or rain-shadow regions) are still influenced by the monsoon system.

8. Collect picture of houses and clothing of people from different regions of India. Examine whether they reflect any relationship with the climatic conditions or the relief of those regions.

Ans. Yes, the houses and clothing of people in different regions of India clearly reflect the climatic conditions and relief of those regions.

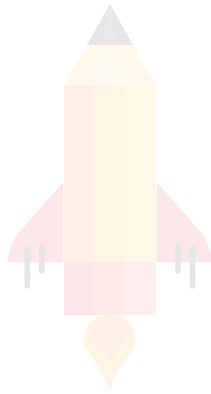
- **In mountain regions**, houses have sloping roofs to prevent snow from collecting, and people wear heavy woollen clothes to keep warm in the cold climate.
- **In rainy regions**, houses are built on stilts to protect from floods and have sloping roofs for rainwater to flow off easily. People wear light clothes and use umbrellas or raincoats.
- **In desert regions**, houses have thick walls and small windows to keep the interior cool, and people wear loose cotton clothes and turbans to protect themselves from heat and dust.
- **In coastal regions**, houses are well-ventilated to cope with heat and humidity, and people wear light cotton clothes to stay comfortable.

Conclusion: Thus, there is a strong relationship between climate, relief, and the lifestyle of people, as seen in their houses and clothing.

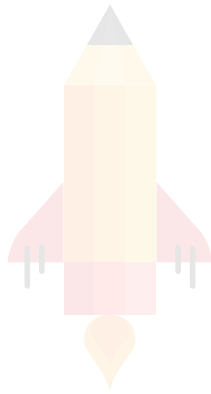
HOUSES AND CLOTHING IN DIFFERENT REGIONS OF INDIA

REGION	HOUSES	CLOTHING	CLIMATE
1. MOUNTAIN REGIONS (e.g., Himachal Pradesh, Kashmir) 	 Sloping roofs to prevent snow accumulation; made of wood to keep interiors warm.	 Heavy woollen clothes like shawls and coats to protect from cold.	 Very cold, snowfall in winters.
2. RAINY REGIONS (e.g., Meghalaya, Assam) 	 Built on stilts (raised platforms) to avoid flooding; sloping roofs for heavy rain.	 Light clothes with use of umbrellas/raincoats due to frequent rainfall.	 Heavy rainfall throughout the year.
3. DESERT REGIONS (e.g., Rajasthan) 	 Thick walls and small windows to keep interiors cool; often made of mud.	 Loose cotton clothes and turbans to protect from heat and dust.	 Hot and dry climate.
4. COASTAL REGIONS (e.g., Kerala, Tamil Nadu) 	 Well-ventilated with sloping roofs to deal with humidity and rain.	 Light cotton clothes to stay cool in hot and humid weather.	 Hot and humid with heavy rainfall.

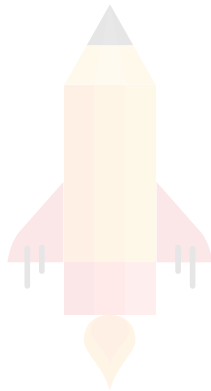
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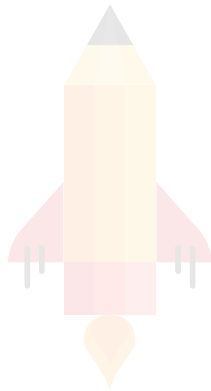
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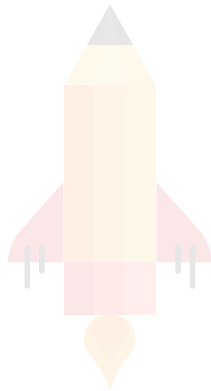
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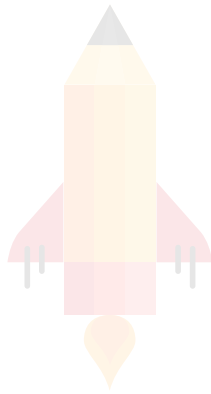
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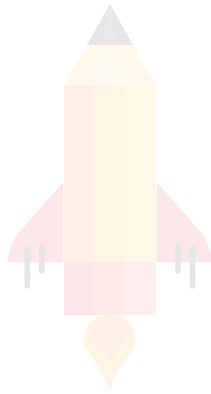
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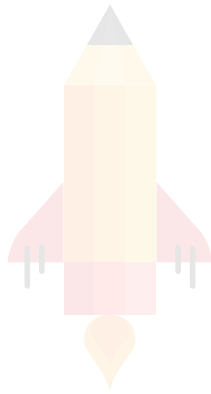
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