



Class 9 Social Science – Chapter 3

NCERT Textbook Solutions – Atmosphere and Climate

Book: *Understanding Society: India and Beyond*

Class: 9 | **Session:** 2026–27

These solutions are based on the **official Chapter 3 textbook PDF you provided**, including the end-of-chapter questions, activities, Table 3.3 and the chapter's explanations.



Chapter 3 – Questions and Activities

Q1. What is atmosphere? Explain its composition with the help of a pie diagram.

 **Answer:**

The **atmosphere** is the blanket of air surrounding the Earth. It is held around the Earth by gravity and consists of a mixture of different gases. It is essential for life and protects the Earth from harmful solar radiation while helping regulate its temperature.



Composition of the Atmosphere

According to the textbook:

-  **Nitrogen – 78%**
-  **Oxygen – 21%**
-  **Argon – 0.93%**
-  **Carbon dioxide – 0.04%**
-  **Others – 0.03%**

The atmosphere also contains **water vapour and tiny dust particles**.



For the pie diagram:

Draw a circle and divide it into sectors representing:

78% Nitrogen + 21% Oxygen + 0.93% Argon + 0.04% Carbon Dioxide + 0.03% Others

Q2. Draw a labelled diagram of the structure of atmosphere.



Answer:

The atmosphere is divided into **five major layers** according to changes in temperature and density with increasing altitude.



Layers of the Atmosphere

1. Troposphere

- Extends to about **12 km**.
- Contains the air we breathe.
- Contains most water vapour and clouds.
- Almost all weather phenomena occur here.

2. Stratosphere

- Extends up to about **50 km**.
- Relatively free from clouds and weather disturbances.
- Contains the ozone layer.
- Suitable for aeroplane flights.

3. Mesosphere

- Extends up to about **80 km**.
- Temperature decreases with altitude.
- Most incoming meteorites burn up here.

4. Thermosphere

- Extends from about **80 to 700 km**.
- Temperature rises rapidly with altitude.
- Contains the ionosphere.

- Auroras occur here.

5. Exosphere 🚀

- The uppermost layer.
- Air is extremely thin.
- Light gases such as helium and hydrogen can escape into space.

Diagram labels:

Earth → Troposphere → Stratosphere → Mesosphere → Thermosphere → Exosphere

Q3. Which are the four main seasons of India?

✅ Answer:

According to the Indian Meteorological Department (IMD), India has four main seasons:

1. ❄️ **Winter** – December to early April
2. ☀️ **Summer or Pre-monsoon** – April to June/July
3. 🌧️ **Monsoon or Rainy Season** – June to September
4. 🍂 **Post-monsoon or Retreating Monsoon** – October to December

The Himalayan states, because of their more temperate climate, experience two additional seasons: **autumn and spring**.

Q4. Why do you not feel the pressure of the atmosphere?

✅ Answer:

The atmosphere exerts pressure on our bodies from **all directions**.

However, our bodies also exert an equal counter-pressure from inside. These pressures balance each other, so we normally do not feel the atmospheric pressure.

 **In simple words:**

Atmospheric pressure outside = Counter-pressure inside our body

Therefore, we do not normally feel the pressure of the atmosphere.

Q5. In which layer of the atmosphere do aeroplanes fly and why?

 **Answer:**

Aeroplanes generally fly in the **stratosphere** because this layer is relatively free from clouds and major weather disturbances.

The stratosphere extends up to about **50 km** and contains the ozone layer, which protects the Earth from harmful ultraviolet radiation.

Q6. Distinguish between the following:

(a) Troposphere and Stratosphere

Feature	 Troposphere	 Stratosphere
Position	Lowest layer	Above the troposphere
Height	About 12 km	Extends up to about 50 km
Weather	Almost all weather occurs here	Relatively free of weather disturbances
Temperature	Decreases with altitude	The textbook notes it as a distinct layer containing ozone and suitable for aircraft
Water vapour	Most atmospheric water vapour and clouds are here	Much less cloud/weather activity

Special feature	Weather phenomena	Contains ozone layer
Importance	Supports weather and life	Protects from harmful UV radiation and provides suitable conditions for aircraft

The textbook specifically states that temperature decreases with altitude in the **troposphere**, while the stratosphere is relatively free of clouds and weather disturbances and contains ozone.

(b) South-West Monsoon and North-East Monsoon

Feature	 South-West Monsoon	 North-East Monsoon
Other name	Summer monsoon	Winter monsoon
Period	June–September	October–February
Wind direction	Sea → Land	Land → Sea
Pressure	Low pressure over India; higher pressure over ocean	High pressure over land; lower pressure over sea
Main cause	Unequal heating of land and sea	Faster cooling of land than surrounding oceans
Rainfall	Provides most of India's annual rainfall	Gives important rainfall to south-eastern India
Important areas	Large parts of India	Tamil Nadu, Andhra Pradesh and parts of Karnataka

The textbook explains that the south-west monsoon brings moist winds from the surrounding seas towards India, while the north-east monsoon generally carries dry winds from land towards the sea but picks up moisture over the Bay of Bengal and brings rainfall to parts of India's eastern coast.

Q7. Study the temperature and rainfall data and convert them into temperature and rainfall graphs.

✓ Answer:

This is a **data interpretation activity**. The textbook provides average monthly temperature and rainfall data for 10 representative stations.

 **Stations given:**

1. Bengaluru
2. Mumbai
3. Kolkata
4. Delhi
5. Jodhpur
6. Chennai
7. Nagpur
8. Shillong
9. Thiruvananthapuram
10. Leh

For each station, students should prepare a **climograph** showing:

-  Monthly temperature
-  Monthly rainfall

The textbook has already provided **Delhi's temperature and rainfall graph as Figure 3.14** as an example.

Q7.1. Re-arrange the 10 stations according to their distance from the equator.

✓ Answer:

Using the latitudes given in Table 3.3, arrange them from **nearest to the Equator to farthest from the Equator**:

1. 🌴 **Thiruvananthapuram** – 8°29'N
2. 🌴 **Bengaluru** – 12°58'N
3. 🌴 **Chennai** – 13°4'N
4. 🌴 **Mumbai** – 19°N
5. 🌿 **Nagpur** – 21°9'N
6. ☁️ **Kolkata** – 22°34'N
7. ⚡️ **Shillong** – 24°34'N
8. 🌵 **Jodhpur** – 26°18'N
9. 🏙️ **Delhi** – 29°N
10. ⚡️ **Leh** – 34°N

The latitudes are given directly in the textbook's Table 3.3.

Q7.2 (a). Find two stations with the most extreme climate.

✅ **Answer:**

The two stations showing particularly contrasting climatic conditions are:

⚡️ **Leh**

- Very cold winters.
- Very low annual rainfall.
- High altitude of **3506 m**.

🌴 **Thiruvananthapuram**

- Temperatures remain relatively high throughout the year.
- Receives much more rainfall.
- Located close to the Equator.

The temperature and rainfall figures in Table 3.3 clearly show the strong contrast between these two stations.

Q7.2 (b). Two stations influenced by retreating monsoons

✓ Answer:

The two stations are:

- 🌧️ Chennai
- 🌴 Thiruvananthapuram

Chennai receives particularly high rainfall in **October and November**, while Thiruvananthapuram also receives substantial rainfall during the post-monsoon period.

Q7.2 (c). The two hottest stations in:

(i) February

From Table 3.3:

- 🌴 Thiruvananthapuram – 27.3°C
- 🌴 Chennai – 25.7°C

Therefore:

✓ Answer:

Thiruvananthapuram and Chennai.

(ii) June

From the table:

- 🌵 Jodhpur – 33.9°C
- 🏙️ Delhi – 33.3°C

✓ Answer:

Jodhpur and Delhi.

Q7.3 (a). Why does Shillong experience more rainfall than Kolkata?

✓ **Answer:**

Shillong receives more rainfall because of its **location and relief**.

Shillong is situated in the hilly region of Meghalaya, where moist monsoon winds are forced to rise over the hills. As the moist air rises, it cools and causes heavy rainfall.

The data in Table 3.3 show:

- 🌧️ Shillong: **225.3 cm annual rainfall**
- 🌧️ Kolkata: **162.5 cm annual rainfall**

Thus, relief plays an important role in Shillong's high rainfall.

Q7.3 (b). Why does Delhi receive more rainfall than Jodhpur?

✓ **Answer:**

Delhi receives more rainfall than Jodhpur because Delhi is more influenced by the **monsoon winds**, while Jodhpur lies farther west in a much drier region.

The annual rainfall values are:

- 🌧️ **Delhi – 67.0 cm**
- 🌵 **Jodhpur – 36.6 cm**

Therefore, Delhi receives considerably more rainfall than Jodhpur.

Q7.4 (a). Why does Thiruvananthapuram have an equable climate?

✓ Answer:

Thiruvananthapuram has an equable climate because it is located **close to the Equator and near the sea**.

The influence of the surrounding sea reduces extreme variations in temperature. The table shows that its temperatures remain relatively stable throughout the year, ranging from about **26.2°C to 28.7°C**.

Q7.4 (b). Why does Chennai have more rainfall only after the fury of the monsoon is over in most parts of the country?

✓ Answer:

Chennai receives substantial rainfall during the **retreating/post-monsoon period**, especially in October and November.

The north-east monsoon winds generally blow from land towards the sea. However, after passing over the **Bay of Bengal**, they pick up moisture and bring rainfall to the eastern coast, particularly Tamil Nadu.

Chennai's rainfall data show:

- October – **30.6 cm**
- November – **35.0 cm**

This explains why Chennai receives much of its rainfall after the main south-west monsoon season has ended in many parts of India.

Q7.4 (c). Why does Leh have moderate precipitation almost throughout the year?

✓ Answer:

Leh receives **very little precipitation overall**, but the available data show small amounts of precipitation in many months rather than a single pronounced rainy season.

Its annual rainfall is only **8.5 cm**, and its high altitude of **3506 metres** strongly influences its climate.

Q7.5. Despite differences across regions, can you observe evidence that monsoons provide climatic unity to India?

✓ Answer:

Yes. The monsoon provides an important **framework of climatic unity** to India.

Although different regions receive different amounts of rainfall and experience different temperatures, the seasonal reversal of monsoon winds influences a large part of the country.

The monsoon affects:

-  Agriculture
-  Water supply
-  Rivers and reservoirs
-  Farming activities
-  Transport
-  Festivals
-  Employment and livelihoods

The textbook explains that India's agriculture and many aspects of daily life are strongly influenced by monsoon rainfall.

Q8. Collect pictures of houses and clothing of people from different regions of India. Examine whether they reflect any relationship with climatic conditions or relief.

Answer:

Yes. Houses and clothing often reflect the **climate and relief** of a region.

Cold mountainous regions:

People generally need warm clothing such as woollens and jackets. Houses may be designed to protect inhabitants from cold conditions.

High-rainfall regions:

Houses may have features that help deal with heavy rainfall, such as sloping roofs.

Hot and dry regions:

Clothing and housing may be adapted to heat and dryness. Thick walls and designs that reduce heat inside buildings can be useful.

Coastal and warm regions:

Light, breathable clothing is generally more suitable for warm and humid conditions.

Thus, **climate and relief influence human lifestyles, housing and clothing.**

Important Chapter 3 Concept – Climate Change

Although the end-of-chapter questions focus mainly on atmosphere, climate and monsoon, the chapter also discusses **climate change and carbon footprints.**

Climate change refers to long-term changes in weather patterns, including temperature, rainfall and wind. The textbook connects current climate change mainly with human activities such as:

- 🔥 Burning fossil fuels
- 🌳 Deforestation
- 🏭 Industrial pollution

These activities increase greenhouse gases and contribute to rising global temperatures.

Ways to reduce our carbon footprint:

- 🚶 Walk or cycle when practical.
 - 🚌 Use public transport or carpool.
 - 💡 Switch off electrical appliances when not in use.
 - 💧 Use water carefully.
 - ♻️ Reuse and recycle.
 - 🚫 Reduce single-use plastics.
 - 🌳 Plant and protect trees.
 - ☀️ Support renewable energy and sustainable lifestyles.
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Quick Revision – Chapter 3

Atmosphere

Nitrogen 78% + Oxygen 21% + other gases

Layers

Troposphere → Stratosphere → Mesosphere → Thermosphere → Exosphere

Weather

Short-term atmospheric conditions.

Climate

Average weather conditions over a long period, usually **30 years or more**.

India's Four Main Seasons

-  Winter
-  Summer/Pre-monsoon
-  Monsoon
-  Post-monsoon

Monsoon

Seasonal reversal of wind direction.

Climate Change

Long-term changes in weather patterns associated in the chapter with human activities and increased greenhouse gases.

Important Terms

Term	Meaning
 Atmosphere	Blanket of gases surrounding Earth
 Gravity	Force that attracts objects towards Earth
 Troposphere	Lowest atmospheric layer where most weather occurs
 Stratosphere	Layer containing ozone and relatively free of weather disturbances
 Mesosphere	Layer where most incoming meteorites burn up
 Thermosphere	Upper layer where temperature rises rapidly and auroras occur
 Exosphere	Uppermost layer with extremely thin air
 Weather	Hour-to-hour and day-to-day atmospheric conditions
 Climate	Long-term average weather conditions
 Insolation	Incoming solar energy intercepted by Earth
 Humidity	Amount/presence of water vapour in air
 Precipitation	Water falling from the atmosphere as rain, snow, sleet or hail



Wind

Movement of air from high pressure to low pressure



Monsoon

Seasonal reversal of wind direction



Carbon Footprint

Greenhouse gases released as a result of human activities