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Chapter

CLIMATE CHANGE

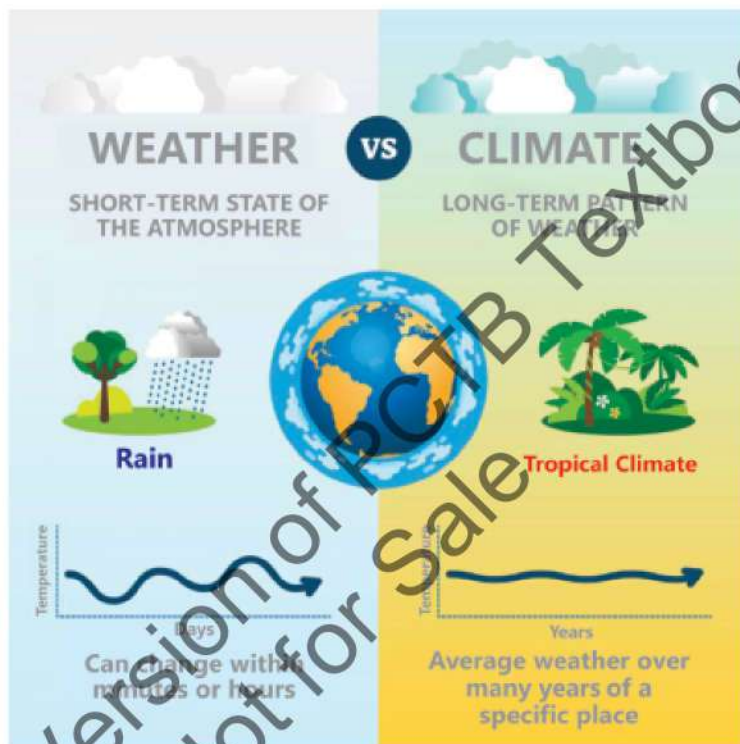
Students' Learning Outcomes:

After completing this chapter, students will be able to:

- Recall the difference between climate and weather.
- Define climate change.
- Explain the greenhouse effect.
- Identify changes caused by the greenhouse effect.
- Describe the importance of the Ozone layer.
- Identify global warming and the greenhouse effect as the main cause of climate change in the world.
- Explain the main causes of climate change in the world and some particular areas.

Difference Between Weather and Climate

Weather is the whole condition of temperature, atmospheric pressure, wind speed, air humidity and precipitation (rain and snow) of a particular place at a particular time. Weather changes with time while the climate is the average weather condition of a particular place that persists there for long time. It is usually taken over 25 to 35 years. The only difference between weather and climate is that weather is short term study of atmospheric condition while climate is long term study of atmospheric conditions.



Climate Change

Carbon dioxide (CO_2) and other Green House Gases (GHGs) absorb the heat coming from the Earth. It increases the temperature of atmosphere which is harmful for life on the Earth. In this way, the climate of the world is affected and it is changing due to rise in air temperature. When volcanism occurs, dust particles and gases, etc. are released in air in huge amount which results in changing the



Climate Change

climate. Similarly emissions of nitric oxide (NO_2) from vehicles and industrial emission like Sulphur dioxide (SO_2) are also polluting the air. A specific amount of carbon dioxide (CO_2) is necessary for life on the Earth. But the quantity of carbon dioxide is rapidly increasing due to excessive use of energy resources such as fossil fuels (coal, oil, natural gas, etc). This change is due to some natural as well as human activities.



Skills

- Use weather charts and climatic maps to identify main areas where major climatic changes are occurring.

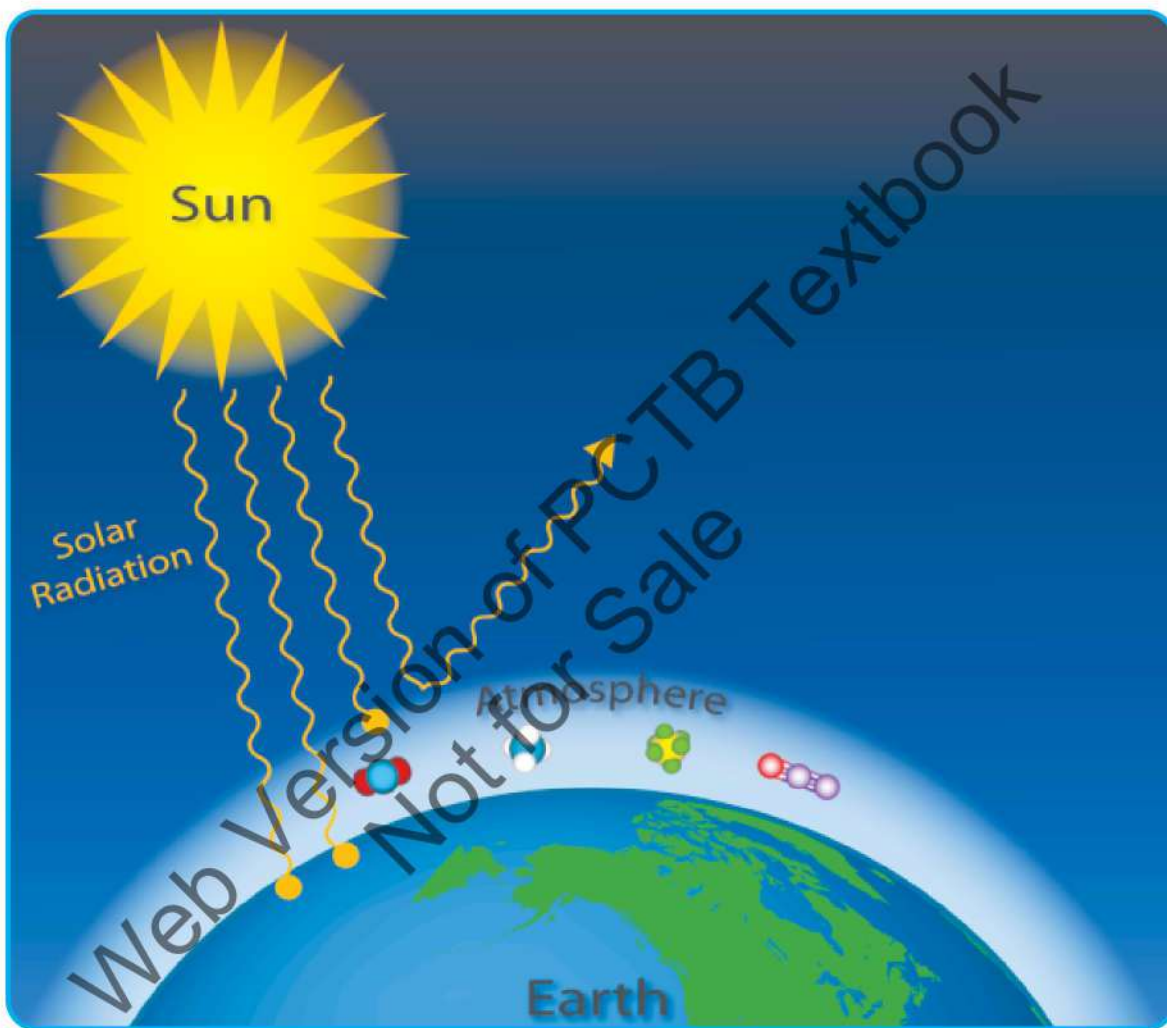
The atmosphere of the Earth changes due to the activities of human beings. Humans make roads, buildings and dams, etc. to fulfill their needs. In 2009, an International Conference was held in Copenhagen (capital of Denmark) on the issue of climate changes. Many countries of the world participated in this conference. Many decisions were taken in this conference to reduce the release of carbon dioxide to control the trend of increasing temperature on the Earth.



Copenhagen Conference 2009

Greenhouse Effect

The greenhouse effect is the way in which heat is trapped close to the Earth's surface by "greenhouse gases." These heat-trapping gases can be imagined as a blanket wrapped around the Earth, keeping the planet warmer. Greenhouse gases include carbon dioxide, methane and water vapours.



Greenhouse Effect

Scientists have determined that warming effect of carbon dioxide helps to stabilize the Earth's atmosphere. Without carbon dioxide, global greenhouse effect would collapse. Without carbon dioxide in the Earth's surface would be 33°C (59°F) cooler.

Greenhouse gases occur naturally and are part of our atmosphere's makeup. The level of carbon dioxide in Earth's atmosphere has been rising consistently for decades and traps extra heat near Earth's surface, causing temperature to rise. This is called global warming i.e. the long-term

heating of Earth's surface observed since the pre-industrial period (between 1850 CE and 1900 CE) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in the Earth's atmosphere.

Do You Know?

Carbon dioxide (CO₂) produced by human activities is the largest contributor to global warming. By 2020 CE, its concentration in the atmosphere had risen to 48% above its pre-industrial level (before 1750 CE).

Changes Caused by the Greenhouse Effect

The main driver of climate change is the greenhouse effect. Greenhouse Effect has far-ranging environmental and health effects. It causes climate change by trapping heat. It also contributes to respiratory diseases from smog and air pollution. Extreme weather, food supply disruptions, and increased wildfires are other effects of climate change caused by greenhouse effect. Changes caused by the greenhouse effect are given as under:

- Flooding of coastal cities.
- Desertification of fertile areas.
- Melting of glacial masses.
- Proliferation of devastating hurricanes.
- Rising of sea level.
- Loss of property.
- Migration from coastal areas to cities.



Skills

- Investigate how human activity is causing climate change.
- Investigate the effects of global warming on polar regions.
- Analyze the effect of climatic change on people, lifestyle, and economy.

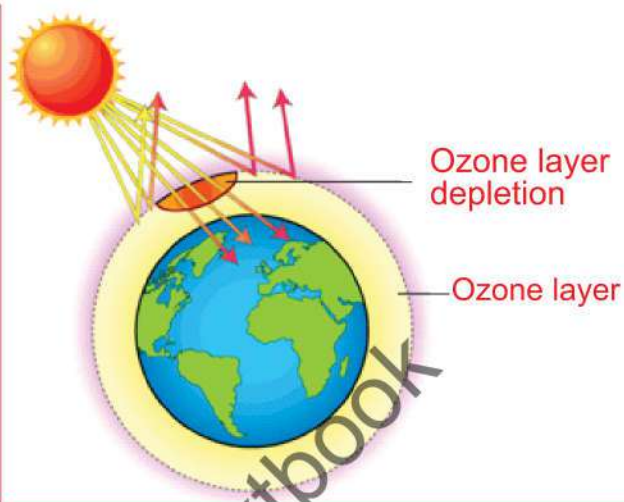
Ozone Layer

Ozone is one of the atmospheric gases. Ozone is produced and destroyed naturally. It is present in the upper portion of atmosphere. It does not let the ultraviolet rays to reach on the Earth. Ultraviolet rays cause skin cancer and eye diseases. If the quantity of ozone gas decreases,

the ultraviolet rays will reach the Earth, which is harmful for life. Therefore, the presence of ozone is necessary.

Causes of Ozone Layer Depletion

Ozone layer depletion is the thinning of the ozone layer present in the upper atmosphere. This happens when the chlorine and bromine atoms in the atmosphere come in contact with ozone and destroy the ozone molecules (O_3). During the industrial revolution, the ozone layer is rapidly depleting because of human activities such as Chloro-Flouro-Carbon (CFCs) which is used in refrigerators and other home appliances.

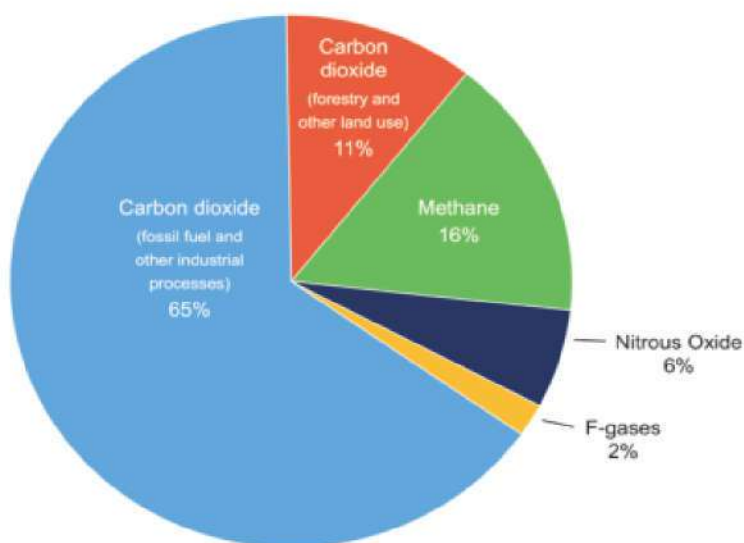


Skills

- Analyze the effects of climate change on the Earth.
- Evaluate the health and environmental effects of smog in Pakistan.
- Investigate and suggest ways to reduce the greenhouse effect.

Main Causes of Climate Change

Carbon dioxide is the main cause of human-induced climate change. It has been emitted in vast quantities from the burning of fossil fuels. It is a long-lived gas, which means it continues to affect the climate system during its long time presence in the atmosphere. Global warming and the greenhouse effect are other main causes of climate change in the world. Since the Industrial Revolution, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, which have changed the Earth's climate. Natural processes, such as changes in the Sun's energy and



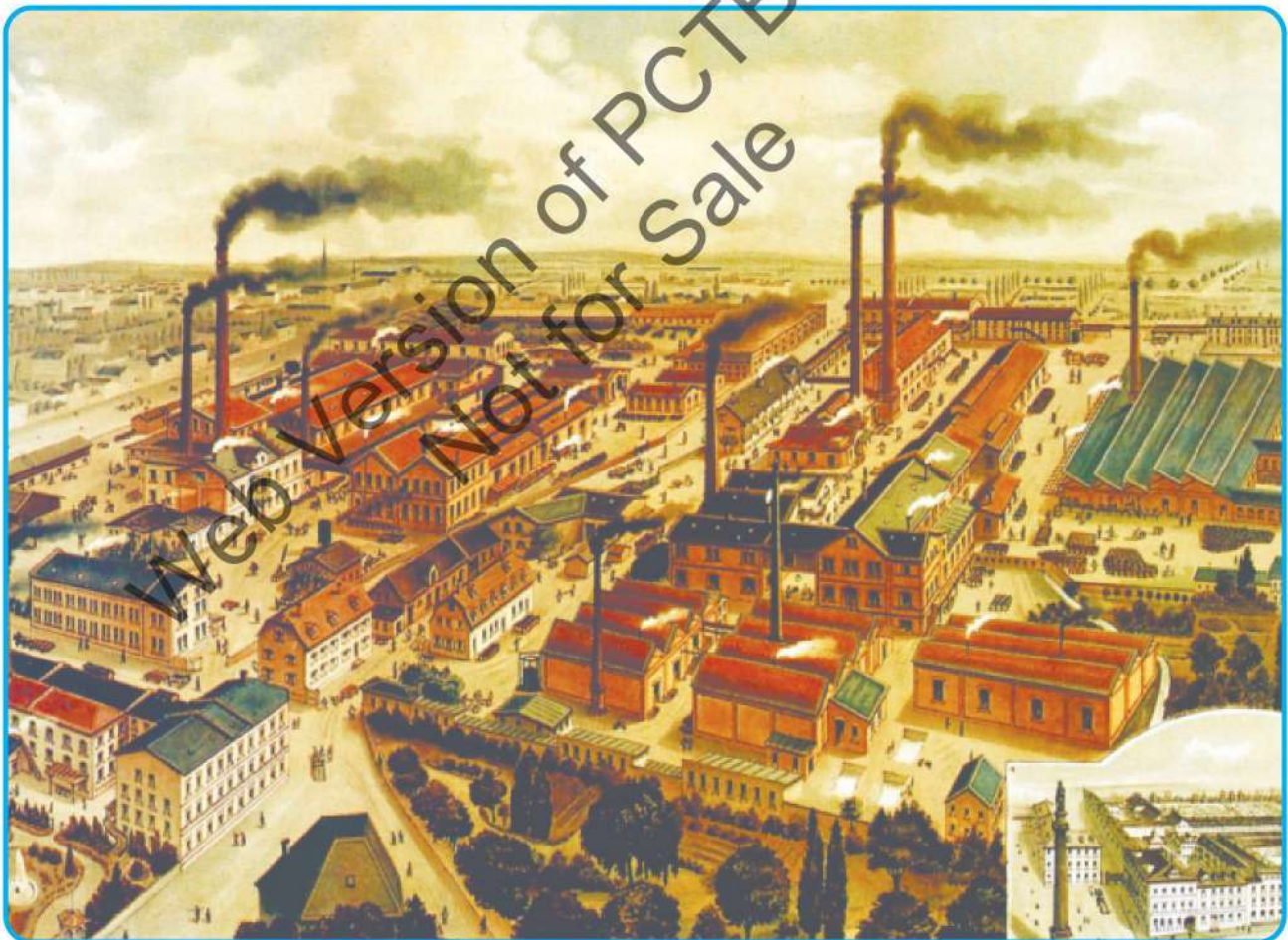
volcanic eruptions, also affect the Earth's climate.

Scientists are analyzing a number of indirect measures of climate change, such as ice cores, tree rings, glacier lengths, pollen remains, and ocean sediments, and by studying changes in the Earth's orbit around the Sun. This record shows that the climate varies naturally over a wide range of time scales.

Activity:

- Analyze the effects of climatic change on flora and fauna.

Since the Industrial Revolution, we have been adding more and more greenhouse gases into the air, trapping even more heat. Instead of keeping the Earth at a warm and stable temperature, the greenhouse effect is heating the planet at a much faster rate. We call this the "Enhanced Greenhouse Effect" and it is the main cause of climate change.



Industrial Revolution

Climate Change Related Events in the World

1. The most extreme heat wave in world history, such as June 2021 heat wave in western north America and in Karachi, (Pakistan) killed many people.
2. European summer floods: Major weather disaster in European history.
3. Flooding in Pakistan in 2010 CE and in 2022 CE are the disastrous impacts of climate change.
4. February 2020 CE cold wave in Central USA and in Pakistan killed many people in Murree.
5. July 2021: Earth's warmest month is recorded in history.
6. Pakistan is ranked sixth in the world in climate risk's index.

Activity:

- Make a plain/project about the main causes of climate change in the world and some particular areas.

Ways We Can Go Green

Global Warming is a gradual increase in the overall temperature of the Earth's cause by increased levels of carbon dioxide, Chloro-Flouro-Carbon (CFCs) and other pollutants. Being green is a state of mind. It is about developing green habits particularly among children. It is need of hour to teach children about "green" means.

The 3R's of Being Green

Three R's are Reduce, Reuse, and Recycle.

Reduce

"Reduce" is about using fewer resources. If children are brushing their teeth, for instance, they do not have to leave the water running the entire time. They need to wet the brush before they



begin, to rinse their mouths and brushes when they are done.

Reuse

"Reuse" is about finding another, green use for an item one would normally consider ready for the trash can. Children may have eaten the contents of a tub of rice pudding, but can he do something with that plastic tub? May be they can use it to sprout seeds for transplanting into a backyard garden or perhaps it can be used for storing craft items, buttons, or to hold nails of a certain size.



Recycle

"Recycle" is about ensuring that all waste is sorted and sent to a recycling plant, where it can be used to make something new. Instead of putting a plastic bottle into a wastebasket, children may store it alongside other empty plastic bottles to be recycled and make into some other item. In doing so children are learning how to reduce the amount of waste they produce and contributing to a greener way to reuse the materials.

Here is a list of some green ways you can teach your children to reduce, reuse, and recycle:

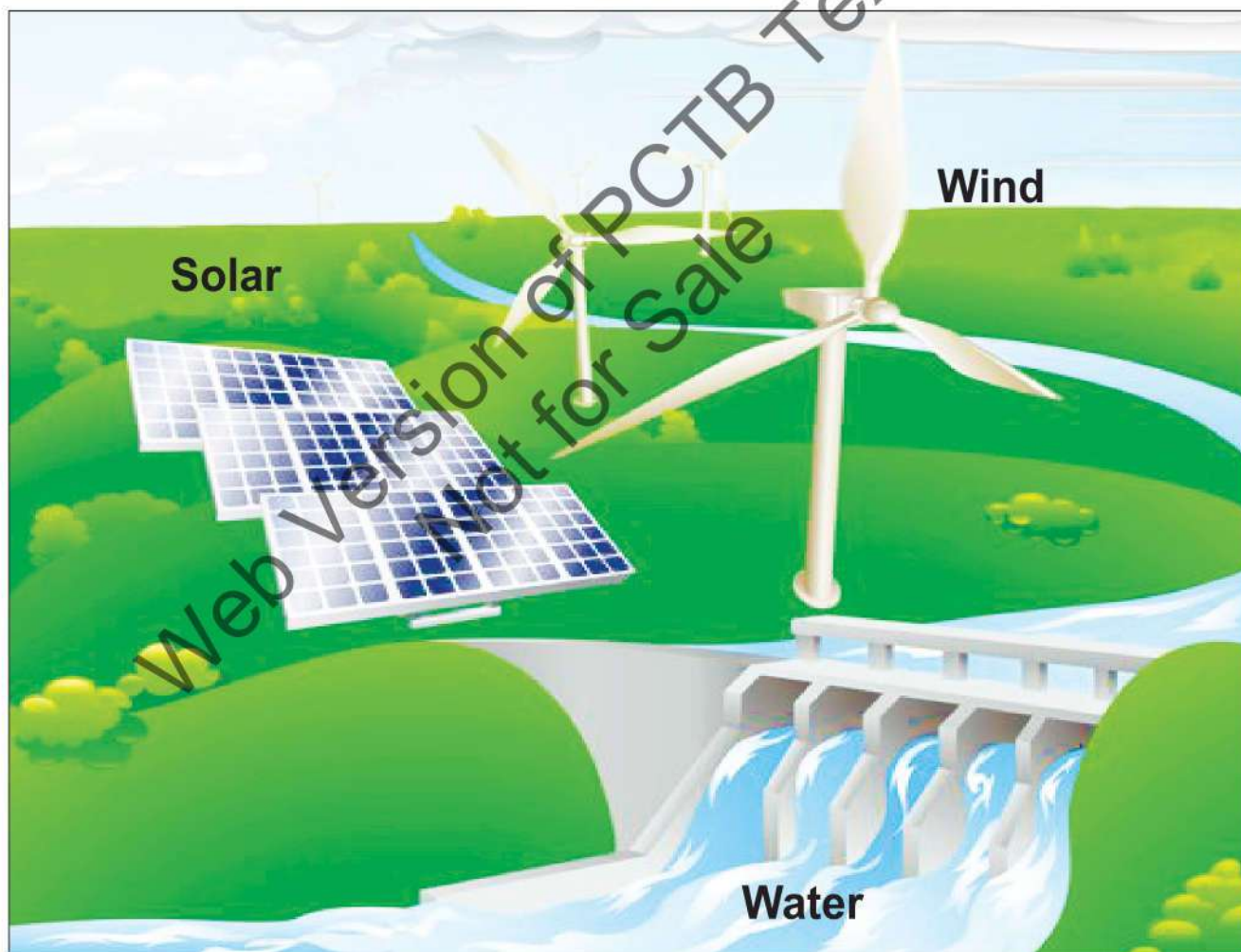
1. Children must turn off the lights whenever they leave a room.
2. Teach children to turn off the water tap when they are brushing their teeth.
3. When the weather is nice, suggest that children walk or ride their bicycles to where they are

going instead of going by car or bus.

4. Teach children to unplug computers and appliances when not in use.
5. Together, make a compost bin and use it!
6. Teach children to always think before throwing things away: Can I use this again?
7. Have your children put out a bucket to catch rainwater? Use it to water plants.

Renewable Energy Sources

Most alternative energy sources are renewable, which means that different fossil fuels, are not likely to run out. Examples of renewable energy sources include the Sun, wind, rivers, oceans, heat from inside the Earth (geothermal energy) and bio fuels. These energy sources can be used to generate electricity and as fuel for vehicles, etc.



Renewable Energy Sources



Information Facts:

- Humans are increasingly influencing the climate and the Earth's temperature by burning fossil fuels, cutting down forests and farming livestock.

What We Have Learnt!

1. Weather is the whole condition of temperature, atmospheric pressure, wind speed, air humidity and precipitation (rain and snow) of a particular place at a particular time.
2. Carbon dioxide (CO_2) and other gases absorb the heat coming from the Earth.
3. Since the Industrial Revolution, we have been adding more and more greenhouse gases into the air, trapping even more heat.
4. The atmosphere of the Earth changes due to the activities of human beings.
5. Ozone (O_3) is produced and destroyed naturally.
6. The greenhouse effect is the way in which heat is trapped close to the Earth's surface by "Greenhouse Gases."
7. In 2009, CE, an International Conference was held in Copenhagen (capital of Denmark) on the issue of climate changes. Many countries of the world participated in this conference.
8. The level of carbon dioxide in the Earth's atmosphere is gradually rising.

EXERCISE

Q.1: Tick (✓) the correct answer.

- i. The gas responsible for rise in the Earth's temperature:
 - (a) sulphur dioxide
 - (b) hydrogen
 - (c) nitric oxide
 - (d) carbon dioxide
- ii. Hydro chloro fluoro carbons (HCFCs) is a:
 - (a) gas
 - (b) liquid
 - (c) solid
 - (d) power plant
- iii. Example of green house gas:
 - (a) helium
 - (b) hydrogen
 - (c) carbon dioxide
 - (d) nitrogen
- iv. Earth's warmest month was recorded in:
 - (a) July 2019
 - (b) July 2020
 - (c) July 2021
 - (d) July 2022
- v. In 2009, an International Conference about global climate change was held in:
 - (a) Seoul
 - (b) London
 - (c) Tokyo
 - (d) Copenhagen

Q. 2: Give short answers of the following:

- i. Differentiate between climate and weather.
- ii. What is Global Warming?
- iii. Which gas absorbs the heat coming from the Earth?
- iv. Write a few benefits of Ozone gas.
- v. Define the term greenhouse effect.

Q. 3: Write the answer of the following in detail:

- i. Analyze the effect of climatic change on the Earth.
- ii. Describe some climatic change related events in the world.

- iii. What changes may be caused by the greenhouse effect? Describe.
- iv. Do you know that Ozone layer is very important? Explain.
- v. Write a note on 3R's.

Learning Activities:

The Teacher will:

- i. Use pictures, videos, etc. to explain the consequences of climatic change.
- ii. Use web links of weather channels, videos, and reading material, involve students and launch a campaign 'Save the Earth'! From Warming.
- iii. Implement 3Rs with activities
 - Promoting green purchasing.
 - Internal reuse of furniture and stationery.

Critical Thinking Questions:

- Suggest some ways to reduce plastic use in daily life?
- Why do we care about Ozone depletion?
- What can we do to stop green house effect?
- How can we use the renewable energy?

Projects For Students:

- Project 3Rs is all about "Reuse, Reduce and Recycle". It is to create awareness among children, parents and the community about the importance of reuse, reduce and recycle.