

GLOBAL ENVIRONMENTAL ISSUES

Structure

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11.1 INTRODUCTION

This is the last unit of this Block on 'Environmental Issues and Concerns'. In Block 2, you must have acquired a good knowledge about the importance of various natural resources, their uses in development and the effect of developmental activities on the environment. More importantly, the need to properly manage the natural resources and environmental conservation have led to the concept of environmental quality management and use of eco-friendly technologies. In Unit 6, Block 2 biodiversity i.e. its value and services have been discussed in detail.

However, in this Block, we discussed the threats to biodiversity and its conservation in Unit 8. In Unit 9, we described the pollution of the environment and how the human health is being affected by the environmental pollution. This was followed by Unit 10 on 'Waste Management' where we focused our discussion on solid waste management.

With a wide exposure to various aspects of the environment in the previous units, it is quite appropriate now to know about various environmental issues which are a matter of concern for *people across the national boundaries*.

This unit covers *global* issues. These issues have become topics of hot discussions at various fora in last few decades. **Global issues** are so named because *their impacts and damages affect not only the countries that caused the problems but they go beyond their national boundaries and extend to the global scale*. Also, the solutions to these issues require efforts at the international level. In this unit, we would discuss some global issues such as *global warming and climate change, ozone layer depletion and acid rain*.

These **global issues** had been matter of debate for long. Here, we have discussed the causes as well as the effects of these phenomena and some of the measures taken to deal with these issues.

According to IPCC, the climate change is defined as a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The UNFCCC thus makes a distribution between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

To meet the challenges posed by the above issues, measures have been initiated at international level in the form of conventions and treaties. Broad features of such conventions and treaties have been briefly enumerated in the unit at appropriate places. In addition, some useful websites have also been listed for further relevant information.

Thus, this unit is a window to the major global concerns. Let us start our journey and join hands to save the environment.

Expected Learning Outcomes

After completing the study of this unit you should be able to:

- ❖ define and list important global environmental issues;
- ❖ give reasons of global warming and relate it to the phenomenon of climate change;
- ❖ discuss the harmful effects of global warming and climate change;
- ❖ explain the causes and effects of ozone layer depletion;
- describe acid rain, its causes and its harmful effects, especially on agriculture, environment, materials and buildings;
- ❖ discuss the impact of the above global issues on human communities and environment; and
- ❖ give names and objectives of various international conventions and treaties related to above environmental issues.

11.2 GLOBAL WARMING AND CLIMATE CHANGE

Climate refers to characteristic atmosphere conditions of a place over long periods of time. Climate can be classified according to latitude as **tropical, subtropical, continental** and **arctic**. It is also referred to as **Mediterranean, monsoon, desert** type etc. The **temperature** and **precipitation** are two important factors among others which influence the climate.

Solar radiation warms the Earth's surface and the atmosphere. About one-third of the radiation is reflected back into space, about 20% is absorbed by the atmospheric gases and the remaining amount reaches the earth surface and is absorbed by it. The energy so absorbed is remitted in the form of infrared radiation. The atmospheric gases absorb some of this radiation and hence do not allow all the emitted energy to escape into the space. Thus, some of the heat is trapped by these gases and the atmosphere becomes warmer. It is this phenomenon which raises the average temperature of earth from -18°C to $+15^{\circ}\text{C}$ and is very vital for life on the earth. The situation is analogous to a **greenhouse** which traps heat and its glass walls do not allow the heat to go out thereby increasing the inside temperature. Therefore, this effect is called **greenhouse effect**.

The gases such as carbon dioxide, methane, ozone, chlorofluorocarbons and

water vapours are responsible for greenhouse effect and are called *greenhouse gases*. The contribution of water to greenhouse effect being about two-thirds and that of carbon dioxide being about one-quarter. The other gases nitrogen (N₂), oxygen (O₂), argon (Ar) present in the atmosphere are incapable of absorbing infrared radiation. The concentration of water vapours in the atmosphere has not changed significantly but that of greenhouse gases has shown a marked increase since the industrial revolution. The anthropogenic (human) activities such as generation of energy from fossil fuels and deforestation have increased CO₂ concentration.

The increase in the concentration of CO₂ and other greenhouse gases leads to an **enhanced greenhouse effect**. This is causing an increase in the global temperature which is known as **global warming**. Studies suggest that temperature has already increased by 0.3°C - 0.6°C since 1860 and the last two decades of the twentieth century were the warmest particularly the year 1998. From 1850 onwards, the decade 2000-2010 had been the warmest one particularly the two years 2005 and 2010 were the warmest years.

This global warming would change global *climate patterns* and cause a *rise in sea levels*. It is estimated that the sea-level may rise by 0.5 m to about 1m.

The rise in sea level is due to thermal expansion of water in oceans and melting of glaciers and polar ice-sheets. This has serious implications for people living on coastal areas and islands.

The other effects of global warming being a *more vigorous hydrological cycle* which may cause more severe floods, rainfall and droughts and *ecological changes* affecting agricultural productivity and survival of forests. A warmer climate may also increase the *infections or diseases* such as malaria, dengue, yellow fever and viral encephalitis.

The increasing concern about the climate change led the World Meteorological Organisation (WMO) and United Nations Environment Programme (UNEP) to establish the **Intergovernmental Panel on Climate change (IPCC)** in 1988. Its First Assessment report was completed in 1990. The Third Assessment report (in 2001) includes results of research about the changes in climate up to the year 2000. It projects an increase in the surface temperature by 1.4°C – 5.8°C by the year 2100 which is higher than 1.0°C – 3.5°C as predicted in the Second Assessment report. Such a warming would be even greater than that which has occurred over last 10,000 years. If the rate of change is temperature is so fast then the ecosystems and organisms would not be able to adapt to the changed environment.

The Fifth Assessment Report was completed in November 2014. IPCC assessments provide a scientific basis for governments to develop climate related policies.

More detailed information is available at the following websites:

<http://www.ipcc.ch/report/ar5/index.shtml>

The UN General Assembly decided to launch negotiations in December 1990 which started in February, 1991. This led to the **United Nations Framework Convention on Climate Change (UNFCCC)** which was adopted in May

Some of the highlights of the 5th Assessment Report are as follows:

- Since the 1950s, many of the observed changes have occurred at a very fast rate. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.
- Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years.
- Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.
- The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19 m.

1992. It was ratified by 50 countries and came into force in March 1994. Till November, 2011, 194 countries and 1 regional economic organization (the European Union) became party to this convention. As of 5th Oct 2016, 144 Parties have ratified the Convention out of 197 Parties.

The UNFCCC aims to *stabilise concentrations of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable the economic development to proceed in a sustainable manner.*

The Parties to the UNFCCC adopted the **Kyoto Protocol** in 1997 which requires the developed countries and economies in transition (Annex 1 countries) to reduce their overall emissions of greenhouse gases by 5.2% below the 1990 levels.

In July 2001, the Sixth Conference of Parties, COP 6 was held in Bonn where a political agreement was held to help the countries to move towards the adoption of Kyoto Protocol. This agreement was formalised in October-November, 2001 as **Marrakesh Accords** at the COP 7 held at Marrakesh, Morocco. The United States unilaterally withdrew but the compromises on key issues such as *funding, technology transfer, adverse impacts of climate change and response measures, flexibility mechanisms and compliance* were arrived at. The details of Marrakesh Declaration are available at

https://unfccc.int/cop7/documents/accords_draft.pdf

<https://cop23.com.fj/knowledge/marrakech-accords-2001/>

The full text of UNFCCC and Kyoto Protocol are available at.

<https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/what-is-the-kyoto-protocol>

<http://unfccc.int/2860.php>

<http://newsroom.unfccc.int/>

http://unfccc.int/kyoto_protocol/items/2830.php

The Eighth session of COP (COP 8) was held at New Delhi from 23rd October – 1st November 2002. The details of the *Delhi Ministerial Declaration on Climate change and Sustainable Development* and other decisions are available at web site <http://unfccc.int/cop8/>

The COP 21st meeting was held in Paris, France from 30th November to 11th December, 2015 and COP 22 was held from 7th to 18 November, 2016 at Marrakesh, Morocco. The COP 23 was organised by Fiji in Bonn from 6-17th November, 2017. The 24th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) was held from 2-14 December 2018, in Katowice, Poland. The main objective of the Polish Presidency at COP24 was to adopt a decision ensuring full implementation of the Paris Agreement (the so-called implementation package - the Katowice Rules).

India is party to the UNFCCC. It signed the treaty on 10th June, 1992 and

ratified the same on 1st November 1993. As the greenhouse gas emissions by India are not very significant and in view of the low financial and technical capacities, India does not have binding of greenhouse gases mitigation commitments.

The Ministry of Environment, Forest and Climate Change is the nodal agency for climate change issues. Various initiatives taken are available at the site <http://www.moef.gov.in/>

Other websites providing useful information on climate change are given below:

- 1) <http://www.unep.org/climatechange/>
- 2) <http://www.moef.nic.in/ccd-napcc> .
- 3) <http://www.moef.gov.in/content/science-express-climate-action-special>

The climate change would affect pattern of rainfall. This may cause floods in some areas while drought in others. The soil moisture may also change. As the climatic factors related to agricultural productivity would change; there would be serious implications on food production. The shortage of food production may lead to malnutrition in people and also the escalation of prices of food commodities.

India is also highly vulnerable to climate change. Our economy depends upon climate sensitive sectors such as agriculture and forestry. Also, our coastline is also densely populated and hence, is under potential threat by rise in sea-level. In case of any natural disaster, people are forced to migrate and there is a chance of heavy loss of human lives and property.

In June 2008, Government India laid down its National Action Plan on Climate Change (NAPCC). The National Action Plan on Climate Change identifies measures that promote our development objectives while also yielding co-benefits for addressing climate change effectively.

There are Eight National Missions which form the core of the National Action Plan, representing multi-pronged, long-term and integrated strategies for achieving key goals with reference to climate change.

This is to be achieved through the following eight missions:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

As a second step, after the National Action Plan on Climate Change (NAPCC) was announced, all States were asked to prepare their State level action plan

to deal with the challenges of climate change. Broadly, the State level action plans are envisioned to be an extension of the NAPCC at various levels of governance, aligned with the eight National Missions.

You can see the following website for detailed information on the effects of climate change in the context of india:

<http://www.terrin.org/climate/impacts.htm>

SAQ 1

What are greenhouse gases? Give some examples.

SAQ 2

What is full form of UNFCCC?

SAQ 3

Discuss the harmful effects of global warming.

11.3 OZONE LAYER DEPLETION

You know that our earth is surrounded by an envelope of atmosphere that contains nitrogen, oxygen, carbon dioxide, ozone, water vapours, dust particles and many other substances emitted as a result of human activities. The atmosphere of the earth can be divided into three zones i.e. *troposphere*, *stratosphere* and *mesosphere* as shown in Fig. 11.1(a). The stratosphere extends from 15 to 50 km and the ozone layer is present in this region.

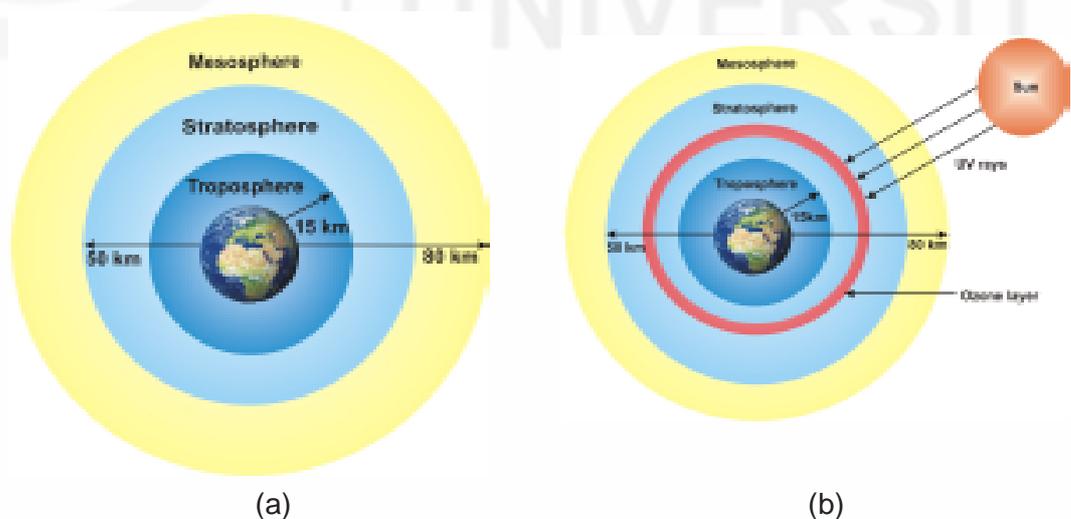


Fig.11.1: (a) Various atmospheric zones and (b) Ozone layer.

The air we breathe in contains oxygen. In oxygen (O_2), two oxygen atoms are joined together whereas in ozone (O_3) three oxygen atoms are bonded together. The peak concentration of ozone is present in the stratosphere being

about 300 ppb (parts per billion) at about 25 kms near the equator and at about 15 kms in polar regions.

This ozone layer of the stratosphere absorbs about 99% of the ultraviolet solar radiation, Fig. 11.1(b). The ultraviolet radiation has wavelength between 0.1 nm and 0.4 nm. It can be further sub-divided into UVA, UVB and UVC in the increasing order energy, see Fig.11.2. The UVB and C are highly energetic and are dangerous to the life on earth, whereas UVA is least energetic and is not dangerous.

UVA is not absorbed by the ozone layer in the atmosphere whereas most of UVB is absorbed and its only 2% to 3% reaches the surface of the earth. Thus, the ozone layer acts as a filter for UVB rays and protects us from the harmful effects of the UV radiation. UVC is absorbed by oxygen and also by ozone in the upper atmosphere.

The concentration of ozone is measured in *Dobson Unit* (DU) where one Dobson unit is equivalent to 1 ppb ozone. The measurements of ozone in the atmosphere began in 1957 by the British Antarctic Survey which in 1985 pointed out significant ozone depletion over Antarctica during spring. The data indicated a decrease in the ozone concentration from about 300 DU in 1970 to about 200 DU in 1984 which increased to around 250 DU in 1988 but dropped to approximately 88 DU in 1994. Thus, the general trend in ozone

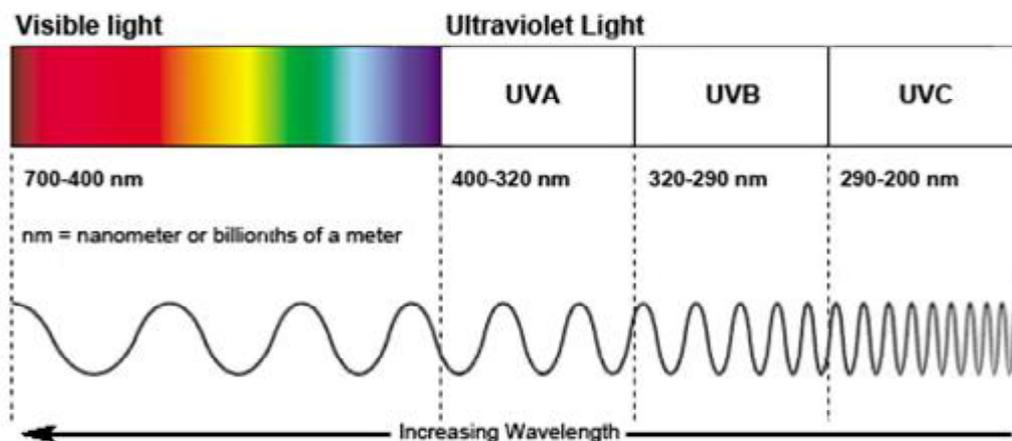


Fig.11.2: Various regions of ultraviolet radiation.

In 1974, Mario Molina and F. Sherwood Rowland suggested that Chlorofluorocarbons (CFCs) are responsible for ozone depletion. The CFCs were used as propellants in spray cans used for packaging shaving creams, hair sprays, deodorants, paints, insecticides etc. CFCs also find use in refrigeration, air conditioning and blowing of foams (used in furniture, bedding, packaging etc.).

The CFCs are very stable unreactive compounds. They are present in the

The group of compounds containing bromine and fluorine and one or two carbon atoms called Halons, are used as fire extinguishers whereas other chlorine containing compounds such as carbon tetrachloride (CCl_4) and 1,1,1-trichloroethane (CH_3CCl_3) are used as solvents and in dry cleaning.

lower region of the atmosphere where they can stay unchanged even for about 100 years as they have atmospheric life-times ranging from 75 to 140 years. When they reach the higher atmosphere, they are broken by the UV radiation and in this process, the highly reactive chlorine atoms are released from them. These chlorine atoms then undergo a series of reactions and deplete the ozone layer. The decrease in the concentration of ozone allows more UVB radiation to reach the earth which has harmful effects on human health, animals, plants, microorganisms, materials and air quality. Some of these are mentioned below:

Effect on Human and Animal Health: Exposure to UVB can cause cataract and skin cancer in humans. It also affects the immune system thereby increasing the risk of infectious diseases.

Effect on Terrestrial Plants: The UVB radiation also affects the physiological and development, processes in plants. The photosynthesis in plants may be impaired leading to decrease in size, the productivity and the quality in many species. It can also cause mutations in plants. Hence, the biodiversity would be affected.

Effect on Aquatic Ecosystems: As the phytoplankton are the starting point in the food chain, reduction in phytoplankton on exposure to UV radiation would affect the fish productivity. In addition, the UV radiation can also damage the early development stages of many aquatic animals.

Effect on Materials: UVB also increases the rate of degradation of polymers

Thus, the depletion of the ozone layer is a matter of concern world wide. An international convention was held in Vienna on March 22, 1985 which led to an international agreement on 16th September 1987 known as **Montreal Protocol** on substances that deplete the ozone layer. A schedule was agreed to completely phase out the ozone depleting substances (ODS), CFCs, Halons, CHCl_3 and CH_2Cl_2 .

The UN General Assembly in January 1995 resolved that 16th September be observed each year as 'International Day for the Preservation of the Ozone Layer' to commemorate the signing of Montreal protocol.

India acceded to the Montreal Protocol on 17th September, 1992. Seven out of twenty substances controlled by the Montreal Protocol are produced and used in India. These are CFC-11, CFC-12, CFC-113, Halon-1211, Halon-1301, Carbon tetrachloride and 1, 1, 1-trichloroethane. The Ministry of Environment, Forest and Climate Change (MOEF) coordinates all matters related to the Montreal Protocol. An *Ozone Cell* has been set up to support and help in the implementation of Montreal Protocol. Many projects are being funded by Multilateral Fund established with UNDP, UNEP, UNIDO and World Bank as implementing agencies, to phase out Ozone Depleting Substances (ODS) and support activities.

In addition, the *National Ozone Unit* (NOU) is entrusted with monitoring and implementation responsibility. Many fiscal measures including exemption from customs and excise duties and other benefits have been announced by the Government of India to those entrepreneurs who are shifting to non-ODS technology. The regulatory measures include Ozone Depleting Substances (Regulation) rules, 2000 which have also been notified in the Gazette of India and cover several aspects of production, sale, consumption, export and import of ODS etc.

More information can be obtained from the following:

- Ministry of Environment , Forest and Climate Change, Ozone Cell, India Habitat Centre, Lodhi Road, New Delhi-110003.
Email : ozone-mef@nic.in
Website: <http://www.ozonecell.com>
New website: <http://ozonecell.in/>

Other useful UNEP sites for the detailed text of Montreal Protocol and amendments, Parties, reports, events are:

<http://www.unep.org/>

<http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer>

<http://www.unep.org/ozone/treaties.shtml>

In India, the production of CFC-11, 12 and 113 has been phased out from 1st August, 2008 and their consumption has been phased out from 1st January, 2010. For Carbon tetrachloride, the production and consumption has been phased out from 1st January, 2010 for Halon-1211 and 1301, the production and consumption has been phased out from 1st January, 2002. The consumption of methyl chloroform has been phased out from January 2001.

United Nations has released a report in November, 2018 which says that the ozone layer is healing, because of the steps taken such as decreased use of CFCs. The ozone layer above the Northern Hemisphere should be completely healed by 2030s. Over the Southern Hemisphere, it should be healed by 2050s. Since 2000, the ozone layer has increased by 1-3 percent in every ten years.

It would be interesting to watch the video given in the following link:

- <https://www.youtube.com/watch?v=PXV6ppONgUk>

SAQ 4

Ozone is present in which zone of atmosphere?

SAQ 5

What are CFCs? Why are they harmful?

SAQ 6

When is ozone day celebrated?

11.4 ACID RAIN

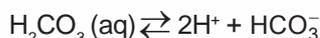
To understand **acid rain**, we have to first know what is meant by an acid. According to Arrhenius definition of acids and bases, *acids* are those substances which release hydrogen ions (H⁺) in aqueous solutions. Acids can

The pH of an acid is defined as follows:

$$\text{pH} = -\log [\text{H}^+]$$

where $[\text{H}^+]$ denotes the concentration of the hydrogen ions.

Carbonic acid is a weak acid and releases H^+ ions on ionisation as shown below:

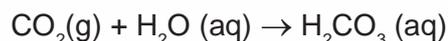


Besides fossil fuels, oxides of sulphur originate from natural sources such as volcanoes and forest fires. The decay of organic matter leads to the generation of hydrogen sulphide (H_2S) gas which also can get converted to sulphuric acid in the atmosphere.

be described strong or weak acids. For example, hydrochloric acid (HCl) is a strong acid while acetic acid (CH_3COOH) (present in vinegar) is a weak acid. The strength of an acid is given by its pH value.

The pH scale ranges from 0 to 14. Acidic substances have pH less than 7 whereas basic substances have pH greater than 7. Water (distilled) has pH value of 7.0.

Even in the unpolluted environment, rain is slightly acidic and has pH of about 5.7. This is because atmospheric carbon dioxide dissolves in rain water and forms carbonic acid as shown below:



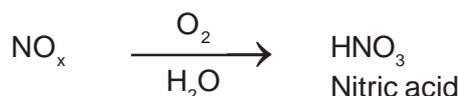
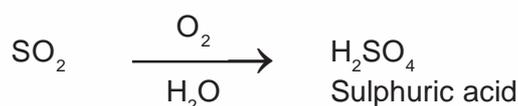
Carbon dioxide Water Carbonic acid

Any form of precipitation such as rain, snow or fog is called **acid deposition** if it has pH less than 5.7. Acid deposition can be classified as **wet deposition** or **dry deposition**. **Wet deposition** includes acids deposited in rain and snow or even fog. **Dry deposition**, on the other hand, refers to deposition of acidic particles and gases in the **absence of moisture**. These deposits stay on the surfaces of water bodies, buildings, vegetation etc. and get washed by the rain to the ground. This acidic water then causes damage the plants, soil and other forms aquatic of life.

The wet deposition in the form of **acid rain** or *acid snow* contain nitric acid and sulphuric acid which are formed by the reaction of oxides of nitrogen and oxides of sulphur, respectively, with water.

When fossil fuels such as coal or oil containing sulphur impurities are burnt, then oxides of sulphur i.e. sulphur dioxide (SO_2) and sulphur trioxide (SO_3) are produced. Similarly, when any organic matter with high nitrogen content is burnt, oxides of nitrogen (NO_x) i.e. nitric oxide (NO) and nitrogen dioxide (NO_2) are produced. The oxides of nitrogen also originate from forest fires, electric power plants and motor vehicles.

These oxides are gases. These oxides such as SO_2 and NO_x on *atmospheric oxidation* and *reaction with water* give sulphuric acid and nitric acid, respectively as shown below:



Both sulphuric acid and nitric acid are strong acids.

The acid precursors and the acids formed by them remain in the air and can move to large distances. This long range transport of acids can go beyond the boundaries of the nations from where these pollutants (gases) originated.

Hence, acid rain is regarded a global issue.

Effects of Acid Rain

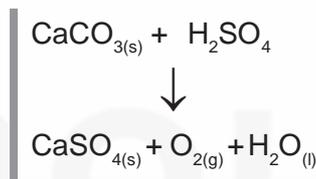
The pH value of acid rain water is around 4. There are many damaging effects of such acidic water. These are discussed below:

Effect on Crops and Plants: The acid rain has detrimental effects on crops and forests. The acid rain can dissolve important minerals and nutrient present in the soil. Soil bacteria and fungi that play important role in nutrient cycling and nitrogen fixation are also affected. Thus, soil fertility is reduced and plant growth is affected.

Effect on water Bodies and Aquatic Life: Water bodies like lakes, rivers and ponds are also affected by the acid rain. The accumulation of acid in them over a period of time lowers the pH and affects the aquatic plants and animals. Many aquatic plants and different types of fish have different tolerance levels for such conditions and hence, cannot survive.

Effect on Human Health: The gases responsible for the acid rain and the acids present in acid rain can affect human health especially the lungs and the respiratory system. The dry depositions from air can cause heart and lung problems such as asthma and bronchitis.

Effect on Materials: Acid rain also damages bridges, buildings, statues and monuments. It can cause corrosion of metals and paints. Many historic monuments are under careful watch now. One such monument in India is Taj Mahal in Agra. The colour of Taj Mahal has already been affected. Buildings made of marble and limestones (CaCO_3) are affected by acid rain.



SAQ 7

What is the pH of normal (unpolluted) rain?

SAQ 8

Name the acids mainly present in acid rain.

SAQ 9

Why do buildings made of marble get discoloured over a period of time?

11.5 ACTIVITIES

1. Browse various websites related to the issues mentioned in this unit.
2. Make a list of useful websites other than those mentioned in the unit.
3. Participate/ Organise discussions, seminars, debates on these at appropriate fora and compile people's opinion on these issues.
4. Popularise, to the extent possible, these issues and concerns through schools/colleges/ universities/NGOs.

5. Display posters, banners etc. related to these issues in your locality / organisation to create public awareness.
6. Celebrate various occasions like the Environment Day, Ozone Day etc. actively in your locality/institution.

11.6 SUMMARY

- In this unit, we have tried to draw attention to various issues which are a matter of worldwide concern because of their harmful effects on human health and the environment.
- We have discussed some *global issues* such as global warming and climate change, ozone layer depletion and acid rain which are debated at various levels. These issues were briefly explained and their causes and effects on human health and environment were discussed.
- In all the sections of the unit, various agreements in the form of international conventions, treaties and protocols have been given to emphasise the measures taken to deal with these issues. Also, some useful websites have been mentioned at appropriate places so that more information can be obtained about various aspects of these issues.

11.7 TERMINAL QUESTIONS

1. Explain 'greenhouse effect'.
2. Discuss the effects of climate change with special reference to India.
3. Differentiate between dry deposition and wet deposition.
4. Name different zones of atmosphere.
5. Explain the harmful effects of UV radiation on human health.
6. What is ozone hole?
7. Why is normal rain acidic?
8. List the sources of oxides of nitrogen and sulphur in the atmosphere.
9. Briefly explain the harmful effects of acid rain.

11.8 ANSWERS

Self-Assessment Questions

1. Gases present in the atmosphere which absorb the radiation (heat) and do not allow it to escape are called green house gases. The examples of green house gases are carbon dioxide, ozone, methane and chlorofluorocarbons.
2. The full form of UNFCCC is United Nations Framework Convention on Climate Change.
3. Global warming will lead to climate change which can in turn affect the pattern of rain fall and soil moisture. The change in climatic factors related

to agriculture productivity would affect food production. The climate change would also cause rise in sea level which would be dangerous for the people living near the coast lines.

4. Stratosphere
5. CFCs are chlorofluorocarbons. They are harmful because they cause the depletion of the ozone layer.
6. 16th September
7. About 5.7.
8. Nitric acid and Sulphuric acid.
9. Buildings made of marble get discoloured due to acid rain in the due course of time because of the following reaction:



Terminal Questions

1. Greenhouse effect refers to a situation when the heat is trapped inside a system (such as the atmosphere of the earth) similar to that trapped in glass walls of a green house which cannot escape and, therefore, results in the increase in temperature of the system.
2. Climate change affects the pattern of rainfall and soil moisture. Since India is a country where the economy is largely based on agriculture, the change in rain fall patterns clearly affects the agricultural productivity. This will have serious implications on the crop yield. Also, lot of people live near the coast line. If the sea level rises, the lives of these people and human settlements near these areas would be badly affected.
3. Dry deposition means settling of acidic particles and gases in the absence of moisture. These deposits can settle on tree leaves, buildings and other places. Wet deposition means any type of precipitation in the form of rain, snow or fog.
4. Troposphere, stratosphere and mesosphere.
5. The UVB radiation can cause cataract and skin cancer in humans. It can also affect the immune system in humans which increases in the risk of infectious diseases.
6. The depletion or thinning of ozone layer is called ozone hole.
7. Normal rain is acidic because the atmospheric carbon dioxide dissolves in rain water and forms carbonic acid (H_2CO_3).
8. Oxides of sulphur originate from the burning of fossil fuels such as coal or oil which contain sulphur impurities. The oxides of nitrogen are produced when organic matter containing high nitrogen content is burnt.
9. Acid rain dissolves the important minerals and nutrients present in the soil and reduce the soil fertility. This affects the growth of the plants. It also affects the soil bacteria and fungi. The accumulation of acid rain in water

bodies affects aquatic plants and animals. The acid rain also affects the fish population of the water bodies. In humans, acid rain can cause health problems related to lungs and respiratory systems. Acid rain also damages monuments, buildings, bridges, metals, paints etc.

11.9 FURTHER READING

- Environmental Science, G. Tyler Miller and Scott E. Spoolman, Cengage Learning, 16th Edition, 2018
- Environmental Science, Daniel D. Chiras, Jones & Bartlett Learning, 10th Edition, 2016.
- Links to Climate Change at <http://enfor.nic.in/>
- News related to global warming
EPA Global Warming site: Newsroom
<https://www3.epa.gov/climatechange/>
- Environmental News Network Special Reports on Climate Change and Global Warming
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- Intergovernmental panel on Climate Change
<http://www.ipcc.ch/>
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- <http://www.unep.org/climatechange/>
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