UNIT 8 : ATMOSPHERIC ENVIRONMENT

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8.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know about the atmospheric environment
- know about ozone layer and importance
- explain depletion of ozone layer and the causes of its depletion
- understand the green house and its effect
- explain the acid rain.

8.2 INTRODUCTION

In the earlier units, you have come across the basic concept of environment and its different components. One another significant

component is the Atmosphere. Now -a-days a common issue raised by man is global warming, all are dissatisfied with the about humidity, unbearable hot in summer, deduction of winter days etc. We make complain about the environment but rarely think of why it happens? God has created Us, "HE" has created also the Earth for us to live in peacefully and whole BRAHMANDA (Solar system). The Earth and the its system works flawlessly for the entire Creations, but it is We, the superior animal being destroy it for our interest.

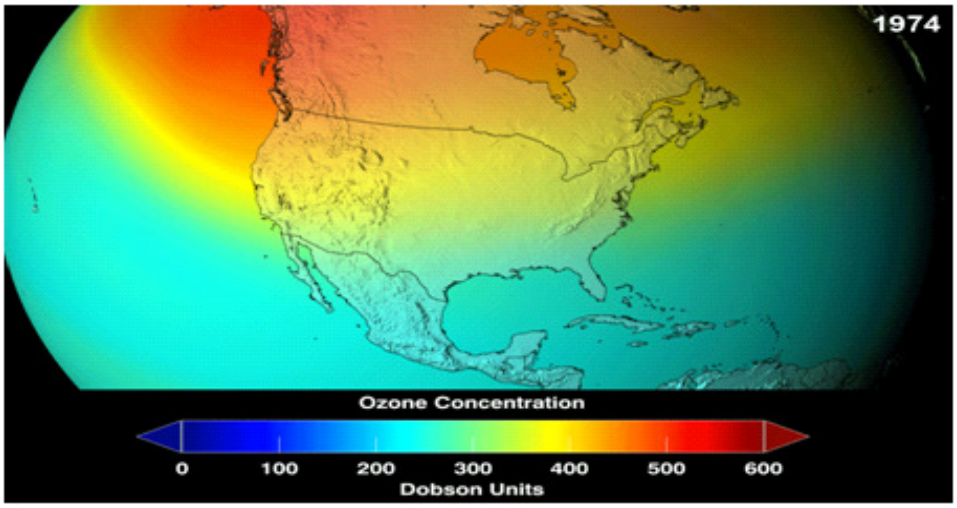
Among different component of environment one important is Atmosphere. It is the multi-layered gaseous envelope surrounding the planet earth. It is the biospheric sphere of Earth. It is the ecosystem as it provides all the gases (air) necessary for the sustenance of all life-forms in the biosphere. In simple sentence, we can term it as an essential condition of the all life form's survival. One of the most important functions of this atmosphere is that it filters the incoming solar radiation and thereby prevents the ultraviolet solar radiation waves from entering the earth surface and protects it from becoming too hot. The atmosphere has significant effect on evolution and development of plants and animals in the biosphere.The present chapter deals with some of the atmospheric processes to human being in terms of Ozone Layer, Green House Effect and Acid Rain and role in the human and all living and non-living organism.

8.3 MEANING OF OZONE LAYER

As you have come to know that the meaning of atmospheric environment as the multi-layered gaseous envelope that surrounds the earth and protect it from the ultra violet solar radiation. There are different atmospheric processes that are useful to human being as well as biotic components of biosphere i.e., plants and animals. One among them is Ozone Layer. Now, the question that arises in your mind is what is Ozone Layer? Let's get the answer-

Ozone Layer is also known as ozonosphere. Before going to know about ozone layer, you should have clear understanding of ozone. It is also known as trioxygen. It is an inorganic molecule. The formula of **ozone** is

O_3. It is the combination of atmospheric oxygen (O_2) and individual oxygen molecule (O), thus results in the **Ozone (O_2 +O –>O_3)**. It is a pale blue gas with a distinctively pungent smell. It is an irritating gas that is explosive and toxic. The ozone gas is unstable because it is created as well as destroyed. The creation and destruction of ozone gas is gradual and natural process. It occurs naturally in small amounts in the **Earth's stratosphere**-a layer of Earth's atmosphere lying between **troposphere** and **mesosphere**. We all have learned about these important sphere of Earth's atmosphere mostly in our school (Spheres of Earth). In this sphere, ozone absorbs the solar ultraviolet radiation.



OZONE LAYER (Source: Wikipedia)

Ozone layer is the lower region of Earth's stratosphere. Ozone presents almost all the altitude of the atmosphere but its concentration is present in the layer from 10km to 50 km. Within this zone the highest concentration of ozone is between 12 km to 35km in the stratosphere. **This zone or layer (12 km to 35km above Earth) of ozone is called Ozone Layer.** It is considered as the protective shield and earth's umbrella because it prevents ultraviolet solar radiation from reaching the earth's surface. The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. It is important for you to know that ozone layer absorbs 97-99 percent of the Sun's medium -frequency ultra-violet light.



LET US KNOW

- **Ozone** is known as trioxyzen. It is an inorganic molecule. The formula of ozone is O_3. It is a pale blue gas with a distinctively pungent smell. It is an irritating gas that is explosive and toxic.
- Ozone presents almost all the altitude of the atmosphere but its concentration is present in the layer from 10km to 50 km. Within this zone the highest concentration of ozone is between 12 km to 35km in the stratosphere. **This zone or layer (12 km to 35km above Earth) of ozone is called Ozone Layer.**
- Ozone layer absorbs 97-99 percent of the Sun's medium - frequency ultra-violet light.



CHECK YOUR PROGRESS

Q 1: What is Stratosphere?

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Q 2: Who discovered Ozone layer?

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Q 3: What is the function of Ozone Layer?

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8.3.1 Importance of Ozone Layer

Ozone layer is very much essential and it is indeed considered as one of the essential component of Environment. From the above discussion you are able to understand the meaning of Ozone and the Ozone layer. It is essential for you to know its importance. Let's discuss why it is considered important-

- Ozone layer is termed as the protective shield or umbrella of Earth.

- It prevents the ultraviolet solar radiation from reaching the Earth's surface by absorbing 97-99 percent of the Sun's medium frequency ultra-violet light.
- It is of vital significance for all biotic including plants, animals as well as man in the biosphere.
- It filters the solar radiation by absorbing unwanted ultraviolet rays and allow only those waves to reach Earth's surface that are essential for planet earth.
- The absence of ozone layer make life measurable as the temperature of Earth's surface and lower atmosphere will rise to such an extent that the "biological furnace" of the biosphere will turn to "blast furnace".

Thus, on the basis on this you can easily realize the importance of ozone layer for the welfare of biotic including human being as it provides protective cover to all organism.



CHECK YOUR PROGRESS

Q 4: Why ozone layer is important for biosphere?

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8.3.2 Depletion of Ozone Layer

We have discussed on ozone layer and its importance. But the topic that has attracted many more at present time related to ozone layer is its depletion. It has turned into a critical issue. It has generated a worldwide concern. We know that ozone layer protect Earth's surface from the ultraviolet solar radiation. As such we can imagine the dangerous consequence of depletion of ozone layer for the Earth. Depletion implies reduction in the quantity. Thus depletion of ozone layer means reduction of the ozone O_3 in the stratosphere. It implies to any changes in the equilibrium level of ozone in atmosphere. This adversely affects the life in the biosphere.

We know that Ozone (O_3) is the combination between O_2 and O. Breaking the ozone (O_3) into O_2 and O results in the depletion or destruction of (O_3). We know that creation and destruction of Ozone is a regular natural process, as already mentioned, but when the destruction of ozone exceeds the level of ozone creation, serious repercussions are bound to crop in the disequilibrium in the level of ozone. This results in ozone depletion. Thus Ozone depletion means gradual thinning of Earth's ozone layer in stratosphere or emergence of hole in the ozone through lowering its density.



LET US KNOW

Depletion of ozone layer means reduction of the ozone O_3 in the stratosphere. Breaking the ozone (O_3) into O_2 and O results in the depletion or destruction of (O_3). It means gradual thinning of Earth's ozone layer in stratosphere through lowering its density.

8.3.3 Factors responsible for Ozone Depletion

To have clear understanding about the process and factors of ozone layer depletion, we can say that by absorbing ultra violet radiation (UV) ozone layer causes temperature inversion. This inversion limits the vertical mixing of pollutants from the biosphere. But when the vertical mixing slows down some pollutants enter the stratosphere and remain there for years until they react with ozone and converted other products. These pollutants deplete ozone in the stratosphere. The major pollutants or culprits responsible for ozone depletion are-Chlorofluorocarbon (CFCs), Nitrogen Oxides (NOx) and Hydrocarbons. The Ozone depletion is a major environmental issue and the man-made as man are responsible for the creation of all these pollutants. Jet Engines, motor vehicles, nitrogen fertilizer and other industrial activities are responsible for emission of CFCs and NOx.

Ozone Depletion is a major threat to environment and the

life in the planet as it increases the amount of UV radiation that reaches Earth's surface. This causes the rate of Skin cancer, Eye Cataracts and genetic damage of immune system.



CHECK YOUR PROGRESS

Q 5: How Ozone layer is depleted?

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8.3.4 Effects of Ozone Depletion

As you know that ozone layer works as the protector and umbrella of Earth's surface from UV solar radiation, hence its depletion is a major threat to environment. It leads to serious temperature change on the earth and consequent damage to life-support system. Let's discuss the effect of Ozone depletion-

- **Disequilibrium in Temperature:** The ozone depletion results in increasing the ultraviolet solar radiation reaching the Earth's surface making it too hot. This leads in rise of the temperature of Earth's surface and lower the atmosphere. This affects the life forms in the biosphere.
- **Rainfall Failure:** The reduction in ozone leads to temperature change and rainfall failure on earth.
- **Increase in Radiation:** It is important for you to know that reduction in Ozone increases UV radiation on earth by 2 percent.
- **Cancer:** It is most adverse effect of ozone depletion on human being. When the ozone becomes thinner or it depletes it causes cancer, specially relating to skin like melanoma. 10 percent decrease in stratospheric ozone leads to approximately 20-30 percent increase in skin cancer.
- **Other Disorder:** The other effects of ozone depletion are

cataracts, destruction of aquatic life and vegetation and loss of immunity.

Depletion of ozone layer has created worldwide concern. Numbers of global efforts have been made to check its depletion. Among them, Vienna Conference 1985, Montreal Protocol 1998, Helsinki Conference 1989 etc are important among them.



CHECK YOUR PROGRESS

Q 6: Mention some of global efforts to check depletion of Ozone Layer.

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8.4 CONCEPT OF GREEN HOUSE EFFECT

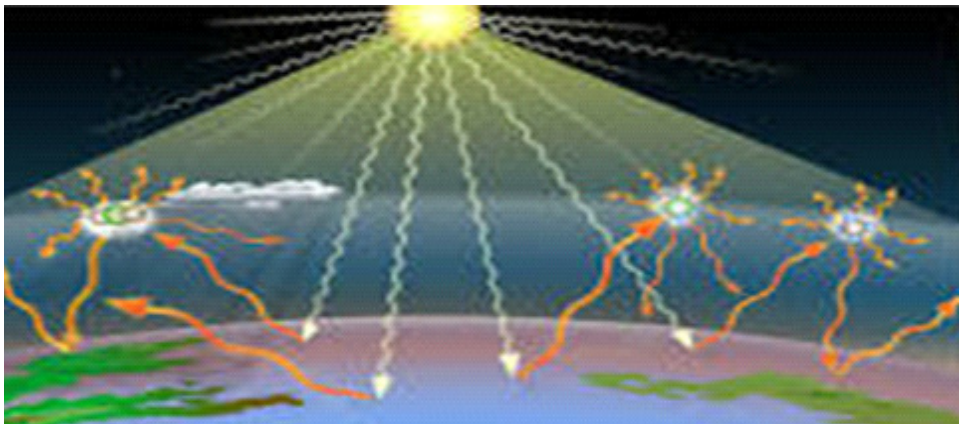
Green house effect is a natural process. Before going to understand about the green house effect, let's know about a "green house". A green house is meant for the plants especially in the cold countries where total isolation at least during winter season is not sufficient enough to support plant growth. The glasses of the green house are such that it allows the visible sunlight to enter but prevent the long wave infrared (electromagnetic) rays to go out. A green house stays warm inside in the winter, in the daytime sunlight shines the plants and air inside, at nighttime, it is colder outside but the greenhouse stays pretty warm inside as the glass wall of the green house trap the Sun's heat.



LET US KNOW

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So as Green house effect means Progressive warming -up of the Earth's surface due to covering up the man made carbon dioxide (CO_2) in the atmosphere. Thus it is natural process that warms the Earth's surface. In simple word, it is a process that occurs when gases in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer that it would be without an atmosphere.



Green House Effect (Source: Wikipedia)

During the day, the Sun shines through the atmosphere. It warms up the Earth's surface. At night, Earth's surface cools, releasing heat back into the air. But, some of the gases of the atmosphere trap the Sun's heat that keeps our Earth warm.Greenhouse gases are- Water vapour, Carbon dioxide, methane, nitrogen oxide, ozone and some artificial chemicals such as Chlorofluorocarbons (CFC_s).When the Sun's energy or light reaches the Earth's atmosphere, some of it is reflected back to space and the rest (30percent) is absorbed by these gases and they are re-radiated to warm up the Earth's surface allowing life on the Earth to exist. This is called Green house effect. Indeed we can say that green house effect is a means to maintain the atmospheric equilibrium; otherwise Earth would be as cold and lifeless as its Moon, or as hot as the Venus. Green House effect works as the exchanger of incoming and outgoing radiation that warms the Earth.