



# ENVIROMENTAL CHEMISTRY

 *Mahendra's*

**MAHENDRA INTERACTIVE CLASS(MIC) BATCH STARTS ON EVERY WEDNESDAY**

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**Environmental chemistry** plays a major role in environment. Chemical species present in the environment are either naturally occurring or generated by human activities.

Environmental pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings.

**Pollutant:** – A substance, which causes pollution, is known as pollutant.

Pollutants can be **solid, liquid or gaseous** substances present in greater concentration than in nature and are produced due to human activities or due to natural happenings.

For example, substances such as dichlorodiphenyltrichloroethane (DDT), plastic materials, heavy metals, many chemicals, and nuclear wastes etc., once released into the environment are difficult to remove.

Pollutants can be **Biodegradable** and **Non-biodegradable**:-

**Biodegradable pollutants**: These are the pollutants which are rapidly broken down by natural processes.

Example: discarded vegetables.

**Non – biodegradable pollutants**: These are the pollutants which are slowly degradable, and remain in the environment in an unchanged form for many decades.

### **Atmospheric pollution**

- i. Tropospheric pollution
- ii. Stratospheric pollution

**Troposphere**:- The lowest region of atmosphere in which the human beings along with other organisms live is called troposphere. It extends up to the height of ~ 10 km from sea level. Troposphere is a turbulent, dusty zone containing air, much water vapour and clouds.

**Tropospheric Pollution**:- Tropospheric pollution occurs due to the presence of undesirable solid or gaseous particles in the air.

The following are the major gaseous and particulate pollutants present in the troposphere:

1. **Gaseous air pollutants**: These are oxides of sulphur, nitrogen and carbon, hydrogen sulphide, hydrocarbons, ozone and other oxidants.
2. **Particulate pollutants**: These are dust, mist, fumes, smoke, smog, etc.

**Acid rain:** Normally rain water has a pH of 5.6 due to the presence of H<sup>+</sup> ions formed by the reaction of rain water with carbon dioxide present in the atmosphere.



Source: Burning of fossil fuels (which contain sulphur and nitrogenous matter) such as coal and oil in power stations and furnaces or petrol and diesel in motor engines produce sulphur dioxide and nitrogen oxides.

SO<sub>2</sub> and NO<sub>2</sub> after oxidation and reaction with water are major contributors to acid rain, because polluted air usually contains particulate matter that catalyses the oxidation.

## Harmful effects:-

Harmful for agriculture, trees and plants as it dissolves and washes away nutrients needed for their growth.

Causes respiratory ailments in human beings and animals.

Affects plant and animal life in aquatic ecosystem when acid rain falls and flows as ground water to reach rivers, lakes etc. Corrodes water pipes resulting in the leaching of heavy metals such as iron, lead and copper into the drinking water.

Damages buildings and other structures made of stone or metal. The Taj Mahal in India has been affected by acid rain.

The gaseous pollutants come down to the earth in the form of acid rain.

Green house effect: About 75 % of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature.

The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by gases such as carbon dioxide, methane, ozone, chlorofluorocarbon compounds (CFCs) and water vapour in the atmosphere. Thus, they add to the heating of the atmosphere. This causes global warming.

This trapping of the sun's heat near the earth's surface and keeping it warm is called natural greenhouse effect. It maintains the temperature and makes the earth perfect for life.

75% of the solar energy reaching earth is absorbed by the earth surface and rest is radiated back to the atmosphere. These gases mentioned above trap the heat which result into global warming.

It is important to realise that these very gases are also responsible for the life on the earth as they trap the requisite amount of solar energy for the sustainance of life.

The increase in the greenhouse gases is raising the temperature of the earth's atmosphere which, if not checked, may eventually result in melting of polar ice caps and consequently may submerge the costal land mass.



**Smog:** Smoke is a mixture of smoke, dust particles and small drops of fog.

### **Classical Smog**

It occurs in cool humid climate. It is a mixture of smoke, fog & sulphur dioxide.

### **Photochemical Smog**

It occurs in warm, dry and sunny climate. Components of photochemical smog result from the action of sunlight on unsaturated hydrocarbons & oxides of nitrogen produced by automobiles & factories.

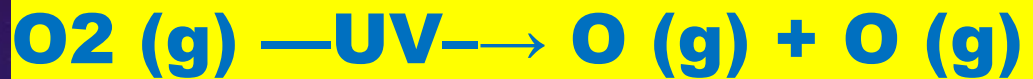
**Stratosphere:** Above the troposphere, between 10 and 50 km above sea level lies stratosphere.

Ozone layer is one of the important constituents of stratosphere. The presence of ozone in the stratosphere prevents about 99.5 per cent of the sun's harmful ultraviolet (UV) radiations from reaching the earth's surface and thereby protecting humans and other animals from its effect.

## Formation and Breakdown of Ozone

The upper stratosphere consists of considerable amount of ozone (O<sub>3</sub>), which protects us from the harmful ultraviolet (UV) radiations (255 nm) coming from the sun.

The UV radiations split apart molecular oxygen into free oxygen (O) atoms. These oxygen atoms combine with the molecular oxygen to form ozone.



Ozone is thermodynamically unstable and decomposes to molecular oxygen. Thus, a dynamic equilibrium exists between the production and decomposition of ozone molecules.

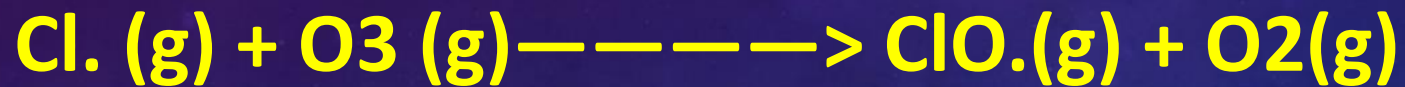
Many human activities are producing chemicals, which are responsible for the depletion of ozone layer in the stratosphere, leading to the formation of ozone hole.

### **Depletion of ozone layer**

The main reason of ozone layer depletion is believed to be the release of chlorofluorocarbon compounds (CFCs), also known as freons.

These compounds are used in refrigerators, air conditioners, in the production of plastic foam and by the electronic industry for cleaning computer parts etc.

Once CFCs are released in the atmosphere, they mix with the normal atmospheric gases and eventually reach the stratosphere. In stratosphere, they get broken down by powerful UV radiations, releasing chlorine free radical.



## Effects of Depletion of the Ozone Layer

UV radiations lead to ageing of skin, cataract, sunburn, skin cancer, killing of many phytoplanktons, damage to fish productivity etc.

It has also been reported that plant proteins get easily affected by UV radiations which leads to the harmful mutation of cells.

It also increases evaporation of surface water through the stomata of the leaves and decreases the moisture content of the soil.

Increase in UV radiations damage paints and fibres, causing them to fade faster.

Water is the elixir of life but the same water, if polluted by pathogens, organic wastes, toxic heavy metals, pesticides etc., will turn into poison.

**THANK YOU**

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