

## **Air pollution**

Air pollution occurs when the air contains gases, dust, fumes or odour in harmful amounts. That is, amounts which could be harmful to the health or comfort of humans and animals or which could cause damage to plants and materials.

### **Bioindicators of air pollution**

Bioindicators are living organisms that respond in an especially clear way to a change in the environment. The hardy lichens are useful bioindicators for air pollution, especially sulfur dioxide pollution, since they derive their water and essential nutrients mainly from the atmosphere rather than from the soil.

### **Natural sources of air pollution**

Natural sources of sulphur dioxide include release from volcanoes, biological decay and forest fires. Natural sources of nitrogen oxides include volcanoes, oceans, biological decay and lightning strikes. Ozone is a secondary photochemical pollutant formed near ground level as a result of chemical reactions taking place in sunlight.

### **Man-made sources of air pollution**

Man is responsible for most of the world's air pollution, both indoors and outdoors. Everything from smoking a cigarette to burning fossil fuels tarnishes the air we breathe and potentially causes health problems as minor as a headache to as harmful as respiratory, lung and heart disease.

### **Tropospheric pollution**

The pollution in the lowest portion of the atmosphere which extends to a height of about 10 km from sea level.

### **Effects of air pollution**

Respiratory and heart problems, global warming, acid rain and depletion of ozone layer.

### **Natural sources of air pollution**

Natural sources of pollution are those that are caused due to natural phenomena. Ex: volcanic eruptions, forest fires, biological decay, pollen grains, marshes, radioactive materials.

### **Man-made sources of air pollution**

Artificial sources are those which are created by man. Thermal power plants, vehicular emissions, fossil fuel burning, agricultural activities etc. are the examples.

### **Remedies taken to control atmospheric pollution**

Encouraging people to use public transport, walk or use a cycle as opposed to private vehicles. Plant trees along busy streets as they remove particulates, carbon dioxide and absorb noise.

### **Air pollutants**

A contaminant that affects human life, plant life, animal life and property or a contaminant which interferes with the enjoyment of life and property could be termed as an air pollutant.

### **Sink for air pollutants**

Air pollutants like CO is being added into atmosphere, yet the level in the air does not rise too much. This is because a significant amount of CO is converted into CO<sub>2</sub> by the micro-organism present in soil or by reaction in the atmosphere. Hence soil can act as sink for air pollutants.

### **Tropospheric pollutants**

1. Carbon monoxide
2. Hydrocarbon
3. Oxides of nitrogen

4.Oxides of sulfur

5.Particulates

### **Gaseous pollutants**

The pollutant such as oxides of carbon, sulphur, and nitrogen, hydrogen sulphide etc. are considered as gaseous pollutants.

### **Particulate pollutants**

The pollutants such as mist, dust, fumes, smoke, smog etc. are particulate pollutants which are present in particle form.

### **Sources of carbon monoxide**

Due to human activity : Incomplete combustion of fossil fuels or hydrocarbons in the automobiles, forest fires.

Natural sources : Conversion of methane produced by the bacterial decay of living matter, from synthesis and decay of chlorophyll.

### **Characteristics of particulate pollutants**

Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

### **Natural and man-made sources of air pollutants**

Natural sources are like volcanic eruption, bacterial and man-made sources like combustion of fuels are responsible for air pollution.

### **Different categories of particulates in atmosphere**

Viable : The viable particulates are of small size living organism such as bacteria , fungi, moulds, algae,etc.

Non-viable : These particulates are formed as a result of the spray of liquids, e.g. from herbicides and insecticides and condensation of the vapors in the air.

#### **Harmful effects of particulate pollutants**

1. Effect on humans : Small sized particulates have greater damaging effect on humans because they can pass through the nose and enter the lungs easily whereas entry of big sized particles is checked in the nose and throat and can be easily removed.
2. Different types of lung diseases are caused by different types of particulates.

#### **Sinks of hydrocarbon**

Hydrocarbons are quite stable. For example, methane has a residence time of about 3 to 7 years. However, they undergo chemical reactions and photochemical reactions through a series of steps and ultimately form products like  $\text{CO}_2$  or other water soluble products which are then washed away by rain.

#### **Natural and man-made sources of hydrocarbon as pollutants**

Natural sources: Trees emit large amount of hydrocarbon into the air. Methane is released into air in large quantities by anaerobic decomposition of organic matter in soil, water and sediments.

Man-made sources : Burning of stationary fuel i.e. coal, wood, kerosene oil etc.

#### **Harmful effects of hydrocarbon**

At low concentrations, as they exist in the air at present, there are no harmful effects of hydrocarbon on human beings. However, if their concentration rises to 500-1000 ppm, they have a carcinogenic effect in the lungs and cause cancer.

#### **Ways to control production of hydrocarbon**

As automobiles are the main source of hydrocarbon pollution, we can use some ways to control production of hydrocarbon.

1. The exhaust system is developed in such a way that it brings about complete combustion of hydrocarbons.
2. The carburettor of engine is adjusted so as to give a proper air-fuel ratio.

### **Sinks of carbon monoxide**

Although a large amount of CO is produced and added in air, yet the level of CO in air does not rise too much. This is because a significant amount of CO is converted into CO<sub>2</sub> by the micro organism present in the soil or by reaction in atmosphere.

### **Harmful effects of carbon monoxide**

Carbon monoxide is poisonous because it combines with hemoglobin of the red blood corpuscles and forms Carboxy haemoglobin's reversibly. This oxy-haemoglobin travels to the different body cells where it gives up oxygen and takes up CO<sub>2</sub> for return to the lungs which is then exhaled out. However, if large CO is present in the surrounding air, it combine more readily with the haemoglobin. The body becomes oxygen-starved and lead to coma and death.

### **Ways to control production of hydrocarbon**

The main source of CO pollution due to human activity is the use of internal combustion engines in the automobiles. These engines emit a mixture of CO, NO<sub>x</sub>, hydrocarbons and particulates. If the carburettor is adjusted so as to give a proper air-fuel ratio emission of CO will be controlled.

### **Carbon dioxide as an air pollutant**

CO<sub>2</sub> is not an air pollutant if present in normal concentration. But if its percentage increase it will results in global warming called as green house effect.

### **Role of hydrogen sulphide as an air pollutant**

Hydrogen sulphide is an poisonous gas which is irritating to the eyes and the respiratory tract. It may cause effects on the central nervous system. Exposure may result in unconsciousness. Exposure may result in death. Hence it is an air pollutant.

### **Role of hydrogen cyanide, hydrogen fluoride, ammonia, lead as air pollutants**

Lead (Pb) is an elemental heavy metal found naturally in the environment as well as in manufactured products. Lead can be released directly into the air, as suspended particles. Once taken into the body, lead distributes throughout the body in the blood and accumulates in the

bones. Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems, and the cardiovascular system. The main local problem of ammonia released into air is the unpleasant odour, which is detectable even at low concentrations. At particularly high concentrations it can also harm vegetation. Low levels of hydrogen cyanide (often from natural sources) are found in all parts of the environment and are not thought to cause any significant environmental damage.

High concentrations of Hydrogen cyanide spillage are however toxic to aquatic life and micro-organisms in soils. Hydrogen cyanide is not expected to have any significant environmental effects at a global level.

Hydrogen fluoride gas is highly corrosive and will damage metal structures and buildings or monuments made of limestone. If high levels of Hydrogen fluoride gas dissolve in a water body, aquatic organisms will be harmed and even killed.

### **Nitrogen oxides sinks**

The average residence time of NO is 4 days while that of NO<sub>2</sub> is 3 days, during this time, they are converted into nitric acid through the reactions. The end product of the reaction is nitric acid. It comes from the atmosphere to the surface of the earth in the form of acid rain. Here, it reacts with the bases such as ammonia, lime to form nitrates.

### **Natural and man-made source of oxides of nitrogen**

Natural sources: It includes bacterial action which discharge NO<sub>x</sub>, mainly in the form of NO.

Man-made sources: Combustion of fossil fuels both in motor vehicle and stationary sources.

### **Harmful effect of oxides of nitrogen**

The concentration NO<sub>2</sub> at 100 ppm may be fatal for animals and human being. Presence of large amount of NO can increase the amount of NO<sub>2</sub>.

### **Methods of control of production of nitrogen oxides**

Just as in case of CO, the catalytic converters are used in the automobile exhaust which in the first stage convert the oxides of nitrogen to free N<sub>2</sub> or to a small amount of NH<sub>3</sub>.

### **Sinks of sulphur oxides**

The sulphur oxides are converted into sulphuric acid which combines with the limestone mineral and thus removed considerably from the atmosphere. Thus, limestone minerals act as sink for sulphur oxides.

### **Natural and man-made source of sulphur oxides**

Natural : Volcanic eruptions are the main natural source.

Man-made sources : Combustion of sulphur containing coal and fuel oil in the thermal power plants. Roasting of sulphides ores in the smelting industries.

### **Harmful effect of oxides of sulphur**

SO<sub>2</sub> and SO<sub>3</sub> are both strongly irritating to the respiratory tract. SO<sub>2</sub> at a concentration of 5 ppm causes throat and eye irritation.

### **Method of control of oxides of sulphur**

It can be controlled by number of ways:

1. By use of low-sulphur or sulphur free fuels like natural gas.
2. By removing sulphur from the fuel before burning.

### **Chemical reaction occurring in the different layers of atmosphere**

All the regions of the atmosphere contain gases. In the presence of sunlight, these gases undergo chemical reactions. Thus, the reactions among these gases are photochemical reactions.

### **Chemical reaction occurring in troposphere**

Troposphere is the lowest region of the atmosphere which lies just above surface of the earth where all biological activities takes place. When sunlight enters this region, CO<sub>2</sub> molecules present in this region absorbs a large amount of energy and get excited. This excited molecule the collide with the other molecules and the excess energy present in them is converted into heat. This heat causes global warming.

### **Chemical reaction in stratosphere**

The main reaction occurring in the stratosphere is the formation of ozone. Ozone is formed in two steps :

Step 1. Dissociation of oxygen gas in oxygen atoms.

Step 2 .These oxygen atoms react with more of dioxygen to form ozone.

### **Reaction occurring in lithosphere**

The troposphere mainly consist gases such as nitrogen and oxygen. Along with water vapor, methane, sulphur dioxide etc. This reason of atmosphere is the site for main life processes.

### **Smog**

Smog is basically derived from the merging of two words; smoke and fog. Smog is a yellowish or blackish fog formed mainly by a mixture of pollutants in the atmosphere which consists of fine particles and ground level ozone.

### **London smog and reasons for its occurrence**

Smog was first observed in London in December 1952 which killed 4000 people. That is why it is called as "London smog". it's occurrence is initiated by a mixture of  $\text{SO}_2$ , particulates and high humidity in the atmosphere.

### **Photochemical smog**

The smog which is formed when the air contains  $\text{NO}_2$  and hydrocarbons and the mixture is exposed to sunlight is called as photochemical smog.

### **Reason for formation of photochemical smog**

In the day time, when air contain nitrogen dioxide and hydrocarbon in large amount then due to sunlight nitrogen dioxide undergoes photolysis to form NO and atomic oxygen. Atomic oxygen then combine with the molecular oxygen of some molecule to form ozone. The ozone then reacts with NO to regenerate nitrogen dioxide and nitrogen oxide.



### **Harmful effect of photochemical smog**

All these compounds produce irritation in the eyes and also in the respiratory system. They also damage many materials such as metals, stones, building materials, etc.

### **Ways to control photochemical smog**

By fitting efficient catalytic converters in the auto-mobile so that the emission of nitrogen oxides and hydrocarbons by these auto-mobiles into atmosphere can be prevented.

By spraying certain compounds into atmosphere which generate free radical.

### **Differentiate between photochemical and classical smog**

Classical smog is formed due to sulphur dioxide and humidity in air which combine to produce sulphuric acid fog. It is formed in the month of winter probably in the morning time.

Photochemical smog is formed by presence of nitrogen dioxide on reaction with sunlight. This occurs in day time.

### **Acid rain**

Rainfall made so acidic by atmospheric pollution that it causes environmental harm, chiefly to forests and lakes. The main cause is the industrial burning of coal and other fossil fuels, the waste gases from which contain sulphur and nitrogen oxides which combine with atmospheric water to form acids.

### **Acid rain**

Normally while rain travels through the air, it dissolves floating chemicals and washes down particles that are suspended in air. At the start of its journey raindrops are neutral ( $\text{pH} = 7$ ). However, when rain falls through the polluted air, it comes across chemicals such as gaseous oxides of sulphur, oxides of nitrogen, mists of acids such as hydrochloric and phosphoric acid, released from automobile exhausts industrial plants, electric power plants etc. These substances dissolve in falling rain making it more acidic than normal with pH range between 5.6 - 3.5. In some cases, its pH gets lowered to the extent of 2. This leads to acid rain.

### **Effects of acid rain**

Acidification affect human nervous system, respiratory system and digestive system.

Acidification of soil adversely affects soil fauna and lead to reduced forest productivity. Acid rain causes extensive damage to buildings and structural material of marble, limestone, slate etc.

### **Causes of acid rain**

The causes of acid rain can be both natural and man-made. Both volcanoes and decaying vegetation release gases that result in the formation of acid rain. However, the majority of gases come from man made sources, such as fossil fuel combustion.

### **Methods to control acid rain**

Acid rain is caused by sulphides and nitrides emitted by chemical companies, vehicles, etc. in air . So by preventing emission of such sulphides and nitrides into atmosphere formation of acid rain can be reduce.

### **Case study of river Ganga**

The settlements built along the river, as well as the dumping of waste water have resulted in the serious pollution in the Ganges. Some people even cremate and dump the bodies of the deceased into the river during holy rituals. Despite this, people still use the river to wash their clothes, bath and carry out their daily activities. WHO has stated that the Coliform bacteria in the Ganges river are over 2800 times higher than the level considered safe for humans. Worse, the leather industry dumps water polluted with chromium into the Ganges, making water there toxic and poisonous.

### **Case study of Taj Mahal**

More recent threats have come from environmental pollution on the banks of Yamuna River including acid rain due to the Mathura Oil Refinery, which was opposed by Supreme Court of India directives. The pollution has been turning the Taj Mahal yellow. To help control the pollution, the Indian government has set up the Taj Trapezium Zone (TTZ), a 10,400-square-kilometre (4,000 sq mi) area around the monument where strict emissions standards are in place.

### **Production of green house effect**

Out of sun's energy entering the atmosphere about 34% is scattered and reflected back and remaining 66% is absorbed by the earth. U.V. and visible radiation can pass through CO<sub>2</sub> and water vapor present in the atmosphere. U.V. radiations are absorbed by ozone layer but visible light reaches the earth and heats it up. This is the production effect of greenhouse gases.

### **Green house effect**

The greenhouse effect is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without its atmosphere.

### **Consequences of greenhouse effect**

If the rate at which solar radiation is arriving the earth remains constant but the amount of carbon dioxide in the air increases, the heat radiated back to the earth will increase. Consequently, the temperature of earth will increase. As a result, a evaporation of surface water will increase which will further help in the rise of temperature. Globe temperature will increase considerably.

### **Global warming**

Global warming is the increase of earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from earth.

### **Gases responsible for greenhouse effect**

Methane, carbon dioxide, chloro fluorocarbon, ozone, nitrous oxide and water vapour

### **Greenhouse gases**

A greenhouse gas is any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. By increasing the heat in the atmosphere, greenhouse gases are responsible for the greenhouse effect, which ultimately leads to global warming. These greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide (N<sub>2</sub>O) and ozone.

### **Causes of green house effect and global warming**

The greenhouse gases that occur naturally in the atmosphere are water vapor, carbon dioxide, nitrous oxide, methane and ozone. A few human activities lead to an increase in the levels of these naturally occurring gases.

The main reasons for the emission of Greenhouse gases and global warming causes and effects thereby, are burning of fossil fuel like coal in the industries for producing electricity. Burning fossil fuel leads to high emissions of carbon dioxide gas. Another green house gas, methane, which is more powerful than CO<sub>2</sub> at trapping the heat in the atmosphere, gets released from resources such as rice paddies, bacteria in bogs and fossil fuel manufacture. Nitrous oxide, also a green house gas is produced during nylon and nitric acid production, cars with catalytic converters, the use of fertilizers and the burning of organic matter. A greater emission of nitrous oxides in the recent decades is leading global warming.

### **Contribution of greenhouse gases in global warming**

The contribution of each gas to the greenhouse effect is affected by the characteristics of that gas, its abundance, and any indirect effects it may cause. The direct radiative effect of a mass of methane is about 72 times stronger than the same mass of carbon dioxide over a 20-year time frame but it is present in much smaller concentrations, so that its total direct radiative effect is smaller, in part due to its shorter atmospheric lifetime.

### **Causes of green house effect and global warming**

Burning of fossil fuels, deforestation, increase in population, farming, industrial waste and landfills.

### **Impact of greenhouse gases on global warming**

Global warming is projected to have a number of effects on the oceans. Ongoing effects include rising sea levels due to thermal expansion and melting of glaciers and ice sheets, and warming of the ocean surface, leading to increased temperature stratification.

### **Ways to reduce greenhouse gases**

Use less heat and air conditioning, replace light bulbs, buy energy-efficient products, use less hot water use the "off" switch, plant a tree, etc.

### **Method to control the rate of global warming**

- 1.By preferring walking or using bicycles or going for car pools or taking public transport.
- 2.By avoiding burning of dry leaves.
- 3.By not smoking and persuading others also not to smoke in public places and work places.

### **Chlorofluorocarbons and give their effects**

Hydrocarbon whose some or most hydrogen atoms have been replaced by chlorine and fluorine atoms are called chlorofluorocarbons. They cause wide 'holes' in the ozone layer through which causes cancerous ultraviolet (UV) rays to reach the earth's surface.

### **Water pollution**

Water pollution is the contamination of water bodies (e.g., lakes, rivers, oceans, aquifers and groundwater), very often by human activities. Any change or modification in the physical, chemical and biological properties of water that will have a detrimental consequence on living things is water pollution.

### **Causes of water pollution**

Cause of water pollution are mainly as:

sewage and waste water  
Marine dumping  
Radioactive waste  
Atmospheric deposition  
underground storage leakages

### **Factors which indicate that water is polluted**

By the determination of Biochemical oxygen demand of the water we can find out whether water is polluted or not. Colour change also indicate water pollution. Death of large amount of aquatic animals in a particular region at particular time indicate pollution in water.

## **Different types of water pollution**

1. Ground water pollution
2. Surface water pollution
3. Lake water pollution
4. River water pollution
5. Sea water pollution

### **Ground water pollution**

Water below the surface of earth is called as ground water. Most of the water is present as ground water. Due to disposal of domestic waste and industrial effluents and use of fertilizers, pesticides a harmful soluble substances dissolve into rain water and pass through the soil and enter into ground water and pollute it.

### **Lake water pollution**

Lakes cover a large part of water area. The water in them gets contaminated by following ways:

1. Organic waste from hills and toxic effluents from urban areas fall into them.
2. Sewage treatment plants discharge toxic organic matter into them.

### **River water pollution**

The main reasons for the pollution of water in the rivers :

1. Industrial discharge including those paper, textile, rayon, fertilizers, pesticides, detergents, drug industries .
2. Domestic sewage discharge.

### **Sea water pollution**

Some of the major sources of sea water pollution are as follows :

1. Discharge of oil waste from tank washings.
2. Wreckage of oil tankers in open sea or accidents of ships carrying oil in the sea.

## **Marine pollution**

Marine pollution occurs when harmful, or potentially harmful, effects result from the entry into the ocean of chemicals, particles, industrial, agricultural and residential waste, noise, or the spread of invasive organisms. Eighty percent of marine pollution comes from land.

## **Sources of water pollution**

Direct sources include effluent outfalls from factories, refineries, waste treatment plants etc., that emit fluids of varying quality directly into urban water supplies. Indirect sources include contaminants that enter the water supply from soils/groundwater systems and from the atmosphere via rain water.

## **Biochemical oxygen demand**

The total amount of oxygen consumed by microorganism in decomposition the waste present in a certain volume of a sample water is called as Biochemical Oxygen Demand of the water.

## **Chemical oxygen demand**

Chemical oxygen demand (COD) is defined as a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant.

## **Effects of water pollution**

Effect of water pollution: Death of aquatic animals( marine life), disruption of food-chains, destruction of ecosystems, diseases etc.

## **Difference between natural and treated water**

Treated water is water that has been made safe for reuse or discharge to the environment, after having been chemically or biologically polluted. Treated water has great importance in industrial applications as well as safe drinking. Natural water from various sources contains dissolved gases, minerals, organic and inorganic substances and is unfit for drinking purposes.

## **Water pollutants**

The various types of water pollutants can be classified into following major categories:

- 1) organic pollutants
- 2) pathogens
- 3) nutrients and agriculture run-off
- 4) suspended solids and sediments
- 5) inorganic pollutants (salts and metals)
- 6) thermal pollution
- 7) radioactive pollutants.

### **Organic water pollutants**

The pollutants which contain organic compounds are called as organic water pollutants. Carbohydrates and proteins, oils from refineries, Aldehydes and Ketones from chemical industries are some examples.

### **Sediments as water pollutants**

Sediments are the soil, rock, or mineral particles which flow along with the streams before entering into water bodies.

### **Action of synthetic detergents as water pollutants**

Synthetic detergents are used as cleaning agent consisting of a surfactant, and builder which is usually sodium phosphate. These synthetic detergents do not undergo biodegradation, they produce stable foam in river, they stabilize the colloidal impurities which do not aggregate to settle down. By this way synthetic detergents act as water pollutants.

### **Oxygen demanding wastes as water pollutants**

Dissolved oxygen is most important for all types of aquatic life. The growth of fish is hindered if the concentration of dissolved oxygen is below 6 ppm. Chemicals which react with dissolved oxygen of water are the main source which reduce the concentration of dissolved oxygen in water, hence act as water pollutants.



### **Role of infectious agents in polluting water**

The municipal sewage and the municipal waste water coming from slums, hostels, restaurants, residential areas, urine of infected patients etc. contain disease causing micro-organisms or bacteria.

### **Sources of oil pollution in seawater**

1. Wreckage of oil tankers in open sea or accidents of ships carrying oil in sea.
2. Discharge of oily wastes from tank washings.
3. Oil leakage from pipeline.

### **Effect of water pollution in sea water**

Oil spill causes heavy damage to fishery. Oil coating makes them unable to respire and clogs their gill slits. Aromatic compounds present in them are a poison for fishes. Oil slick results in reduction of dissolved oxygen.

### **Sewage**

Sewage is waste matter from domestic or industrial establishments that is carried away in sewers or drains for dumping or conversion into a form that is not toxic.

### **Potable water**

Potable water is water which is fit for consumption by humans and other animals. It is also called drinking water, in a reference to its intended use. Water may be naturally potable, as is the case with pristine springs, or it may need to be treated in order to be safe.

### **Explain how water is purified**

Some of the methods of water purification are boiling, chlorine tablet and water filters.

### **Explain how water pollution can be reduced**

Installing sewage treatment plants at strategic locations can help reduce water pollution. Do not throw chemicals, oils, paints and medicines down the sink drain, or the toilet.

### **Role of plant nutrients in polluting water**

The plant nutrients flow into lakes where they support the growth of aquatic plants. These plants on decay produce unpleasant odour. Further, the microorganisms in decomposing these plants consume oxygen and the amount of oxygen in water decreases.

### **Eutrophication**

Excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life is called as eutrophication.

### **Role of pesticides, radiative and thermal pollutants in polluting water**

Radioactive discharge enter into water stream from different sources like nuclear reactors, nuclear tests. The radiation emitted by them are highly hazardous.

Thermal pollutants increases the temperature of the flowing water and hence adversely affect the aquatic life.

Pesticides are chemical compounds used to control growth of unwanted plants but their excessive concentration causes hazards effect.

### **International standard for drinking water**

Water used for drinking must be pure as otherwise it can cause serious diseases. International standards have, therefore been laid down for the water to be used for drinking.

### **soil and its major components**

The upper layer of earth in which plants grow, a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles called as soil.

Components are :

1. Mineral matter

- 2.Organic matter
- 3.Biological system
- 4.Soil water
- 5.Soil air

#### **List and identify the soil pollutants**

1. Industrial wastes.
2. Urban wastes.
3. Agricultural pollutants includes; Fertilizers, Pesticides etc.

#### **Effects of soil pollutants**

1. Effect on Health of Humans: Considering how soil is the reason we are able to sustain ourselves, the contamination of it has major consequences on our health. Crops and plants grown on polluted soil absorb much of the pollution and then pass these on to us. This could explain the sudden surge in small and terminal illnesses.
2. Effect on Growth of Plants: The ecological balance of any system gets affected due to the widespread contamination of the soil.
3. Decreased Soil Fertility: The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield.

#### **Measures to control soil pollution**

1. Use of pesticides should be minimized.
2. Use of fertilizers should be judicious.
3. Cropping techniques should be improved to prevent growth of weeds.
4. Special pits should be selected for dumping wastes.
5. Controlled grazing and forest management.
6. Wind breaks and wind shield in areas exposed to wind erosion
7. Planning of soil binding grasses along banks and slopes prone to rapid erosion.

#### **Industrial pollution and its effects**

Any form of pollution that can trace its immediate source to industrial practices is known as industrial pollution. Industrial soil pollution is creating problems in agriculture and destroying

local vegetation. It also causes chronic health issues to the people that come in contact with such soil on a daily basis.

### **Method to control industrial pollution**

Recycling and Reuse of wastes: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc. should be recycled and reused.

Industrial wastes should be properly treated at source. Integrated waste treatment methods should be adopted.

### **Sources of soil pollution**

1. Agricultural pollutants
2. Radioactive pollutants
3. Urban wastes
4. Industrial wastes

### **Waste management methods of household waste**

Household waste can be managed by using separate garbage-bins for biodegradable and non-biodegradable wastes like polythene bags, etc. which choke the sewers.

### **Waste management methods of industrial waste**

Industrial waste can be managed by :

1. recycling waste like glass , plastic etc.
2. Burning and incineration e.g., plant leaves, etc.
3. Sewage treatment before disposing it off.

### **Recent developments in waste recycling**

1. The fly ash and slag of steel industry is being utilized by the cement industries.
2. The plastic waste is being converted into fuel which has high octane member. It does not contain any lead. It is known as green fuel.
3. The plastic waste is being utilized to make clothes by the textile industries.

## **Green chemistry**

Green chemistry, also called sustainable chemistry, is an area of chemistry and chemical engineering focused on the designing of products and processes that minimize the use and generation of hazardous substances.

### **Techniques in green chemistry**

1. Use of sunlight and microwaves : The use of sunlight and ultraviolet light have given birth to photochemistry. Thus by use of sunlight and microwaves not only reduced the time of the reaction but have also increased the yields.
2. Use of sound waves : Instead of microwaves, sound waves have also been used to carry out certain known chemical reactions with encouraging results.

## **Environmental chemistry**

Environmental chemistry is the scientific study of the chemical and biochemical phenomena that occur in natural places. It should not be confused with green chemistry, which seeks to reduce potential pollution at its source.

## **Environment**

The conditions in which living beings survive or the circumstances, objects, or conditions by which one is surrounded is called environment.

### **Constituents of environment**

The environment consists broadly of two components. Non-living or physical and living or biological.

### **Social and natural environment**

The social environment, social context, sociocultural context or milieu refers to the immediate physical and social setting in which people live or in which something happens or develops. Whereas the natural environment encompasses all living and non-living things occurring

naturally.

### **Functions of atmosphere**

The atmosphere works as a place to contain the oxygen that is necessary for life, works as a blanket to shield the earth from radiation and helps to create the different types of weather that are felt on the Earth.

### **Different sources of energy**

Solar Energy

Wind Energy

Geothermal Energy

Hydrogen Energy

Tidal Energy

Wave Energy

Hydroelectric Energy

Biomass Energy

### **Describe troposphere**

The troposphere is the lowest layer of Earth's atmosphere and site of all weather on Earth. The troposphere is bonded on the top by a layer of air called the tropopause, which separates the troposphere from the stratosphere, and on bottom by the surface of the Earth.

### **Hydrosphere**

All the waters on the earth's surface, such as lakes and seas, and sometimes including water over the earth's surface, such as clouds.

### **Lithosphere**

The rigid outer part of the earth, consisting of the crust and upper mantle. The lithosphere comprises a number of plates.

### **Biosphere**

The regions of the surface and atmosphere of the earth or another planet occupied by living organisms.

### **Renewable sources of energy with example**

Wind, solar, and hydroelectricity are three emerging renewable sources of energy. Renewable energy is generally defined as energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.

### **Non-renewable sources of energy**

Non-renewable energy comes from sources that will run out or will not be replenished in our lifetimes or even in many, many lifetimes. Most non-renewable energy sources are fossil fuels: coal, petroleum, and natural gas. Carbon is the main element in fossil fuels.

### **Reason for considering sun as primary source of energy**

Sunlight reaching the Earth can heat the land, ocean, and atmosphere. Some of that sunlight is reflected back to space by the surface, clouds, or ice. Much of the sunlight that reaches earth is absorbed and warms the planet. When Earth emits the same amount of energy as it absorbs, its energy budget is in balanced, and its average temperature remains stable.

### **saving energy in homes and institutions.**

By using appliances which works on sunlight like solar cooker, solar panels for generation of electricity, solar heater, etc. we can save energy.

### **Pollution**

Presence of matter (gas, liquid, solid) or energy (heat, noise, radiation) whose nature, location, or quantity directly or indirectly alters characteristics or processes of any part of the environment, and causes (or has the potential to cause) damage to the condition, health, safety, or welfare of animals, humans, plants, or property is called pollution.

### **Pollution associated with consumption of fossil fuels**

Combustion of gasoline, petrol, diesel in the automobiles leads to increase of poisonous gases such as CO in the atmosphere, in addition with oxides of nitrogen and unburnt hydrocarbons.

### **Role of LPG and CNG in pollution control**

LPG is nothing but liquefied petroleum gas while CNG is compressed natural gas, both are petroleum products but on burning they produce energy without emitting gases such as CO.

### **Energy crisis**

According to law of conservation of mass energy of isolated system always remain constant, it just changes the form. If energy is conserved in nature then it will create energy crises.

### **Alternative sources of energy**

Ethanol nowadays are used as additive in fuels, hydrogen gas is used as fuel in rockets, biofuels such as methanol, biodiesel are substitutes of petroleum products.

### **Main causes of pollution**

The combustion of fossil fuels like coal, petroleum and other factory combustibles is a major cause of air pollution. These are generally used in power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices.

### **Pollution model**

According to the pollution model gradual increase in pollution has now reached alarming proportion. Pollution model explains how pollutants enter into environment then assimilated by environments, build up in environments and causes damage to environment. So basically pollution model explains the rate of pollution which is going to harm environment.

### **Threshold limit value**

The threshold limit value (TLV) of a chemical substance is a level to which it is believed a worker can be exposed day after day for a working lifetime without adverse effects. Strictly speaking, TLV is a reserved term of the American Conference of Governmental Industrial Hygienists (ACGIH).

### **Pollutants**

Pollutant is any substance, as certain chemicals or waste products, that renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose.



## **Types of pollutants**

A pollutant is substance that pollutes something, especially water or the atmosphere. They can be either biodegradable or non-biodegradable or primary or secondary pollutants.

### **Physical pollutants**

Those pollutants which are present in the solid form such as aluminium, DDT, Mercury, domestic sewage etc.

### **Chemical pollutants**

All chemical compounds which can mix with water , air and cause pollution is called as chemical pollutants.

### **Biological pollutants**

Those pollutants which disturb the biological system like quality of aquatic and terrestrial environment is called as biological pollutants. For example, during extraction of natural oils from sea some times it falls in sea water and causes damage to aquatic life.

### **Non-biodegradable and biodegradable pollutants**

Biodegradable pollutants are those which can be easily decomposed by natural agents like water, oxygen, ultraviolet rays of the sun, acid rains, micro-organisms etc. eg dead leaf. Those pollutants which cannot be broken down or decomposed into the soil by natural agents are labelled as non-biodegradable, eg plastic bottles.

### **Biodegradable and non-biodegradable**

Biodegradable pollutants are those such as domestic sewage , cow-dung etc. which are decomposed by microorganism either by nature.

Non-biodegradable are those such as mercury , aluminium , DDT etc. which do not undergo degradation or degrade very slowly.

### **Primary and secondary pollutants**

A primary pollutant is an air pollutant emitted directly from a source. A secondary pollutant is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

### **Contamination**

Pollution is harmful to the environment that can prove fatal to all living organisms, is caused by the contamination of the air, water and soil by harmful substances called pollutants.

### **Different types of pollution**

Air pollution

Water pollution

Land pollution