

BAS104 / BAS204

Date.....

ENVIRONMENT AND ECOLOGYUnit:-1

Environmental : Definition, Types of Environment, Components of Environment, Sigmints of environment, Scope and importance, Need of Public Awareness.

Ecosystem : Definition, Types of ecosystem, Structure of ecosystem, food chain, food web, Ecological pyramid, Balance Ecosystem.

Effects of Human Activities such as Forest, shelter, Housing Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environmental Impact Assessment, Sustainable Development.

Unit:-2

Natural Resources : Introduction, Classification

Water Resources : Availability, sources and quality Aspects, Water Borne and Water Induced Diseases, Fluoride and Arsenic Problems in Drinking Water.

Mineral Resources : Material Cycles; Carbon, Nitrogen and Sulfur cycles

Energy Resources : Conventional and Non Conventional Sources of Energy.

Forest Resources : Conventional and Non conventional Sources

Teacher's Sign.....

of Energy.

Forest Resources:- Availability, Depletion of forests, Environment's impact of forest depletion and society.

Unit-3:-

Pop Pollution and their Effects; Public Health Aspects of Environmental; Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid waste management.

Unit-4:-

Current Environmental Issues of Importance; Global Warming, Green House Effects, Climate Change, Acid Rain, Ozone layer Formation and Depletion, Population Growth and Automobile pollution, Burning of paddy straw.

Unit-5:-

Environmental Protection:- Environmental Protection Act 1986,

Initiatives by Non Governmental Organizations (NGO's), Human Population growth, Environmental Education, Women Education.



Environment

Environment means encircle or surrounding.

Definition - The sum total of air, water, land and the inter relationship that exists amongs and them and with the human beings or living organisms and materials.

Segments of Environment

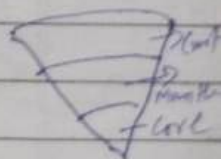
The various segments of the environment are -

1. Lithosphere (land/soil part of earth)
2. Hydrosphere (water part of earth)
3. Atmosphere (gaseous part of earth)
4. Biosphere (living organism exist)

Lithosphere (land/soil part of earth)

(1) Lithosphere mainly contain 3^o layers.

- (i) crust (ii) Mantle (iii) Core



(2) Lithosphere provide soil for agriculture purpose const-ruktion, microorganism or nutrients for plant growth, oil, coal for basic needs.

Hydrosphere (Water part of earth)

(1) Hydrosphere cover more than 75% of the earth surface either as ocean or Fresh water.

(2) Hydrospheres provide water for drinking purpose, washing, irrigation purpose, power generation etc.

Atmosphere. (gaseous part of earth) :-

- (1) It is the blanket of gases surrounding the earth.
- (2) The atmosphere absorb ultraviolet rays from the sun and maintain heat balance of earth.
- (3) Various essential gases are present in the atmosphere like Oxygen, Carbon dioxide, Nitrogen.

Biosphere. (where living organism exists)

- (1) Biosphere is a thin layer on the earth in which life can exist.
- (2) Biosphere is a biological environment in which living organism interact with physical environment.
- (3) It is a sum of all Ecosystem.

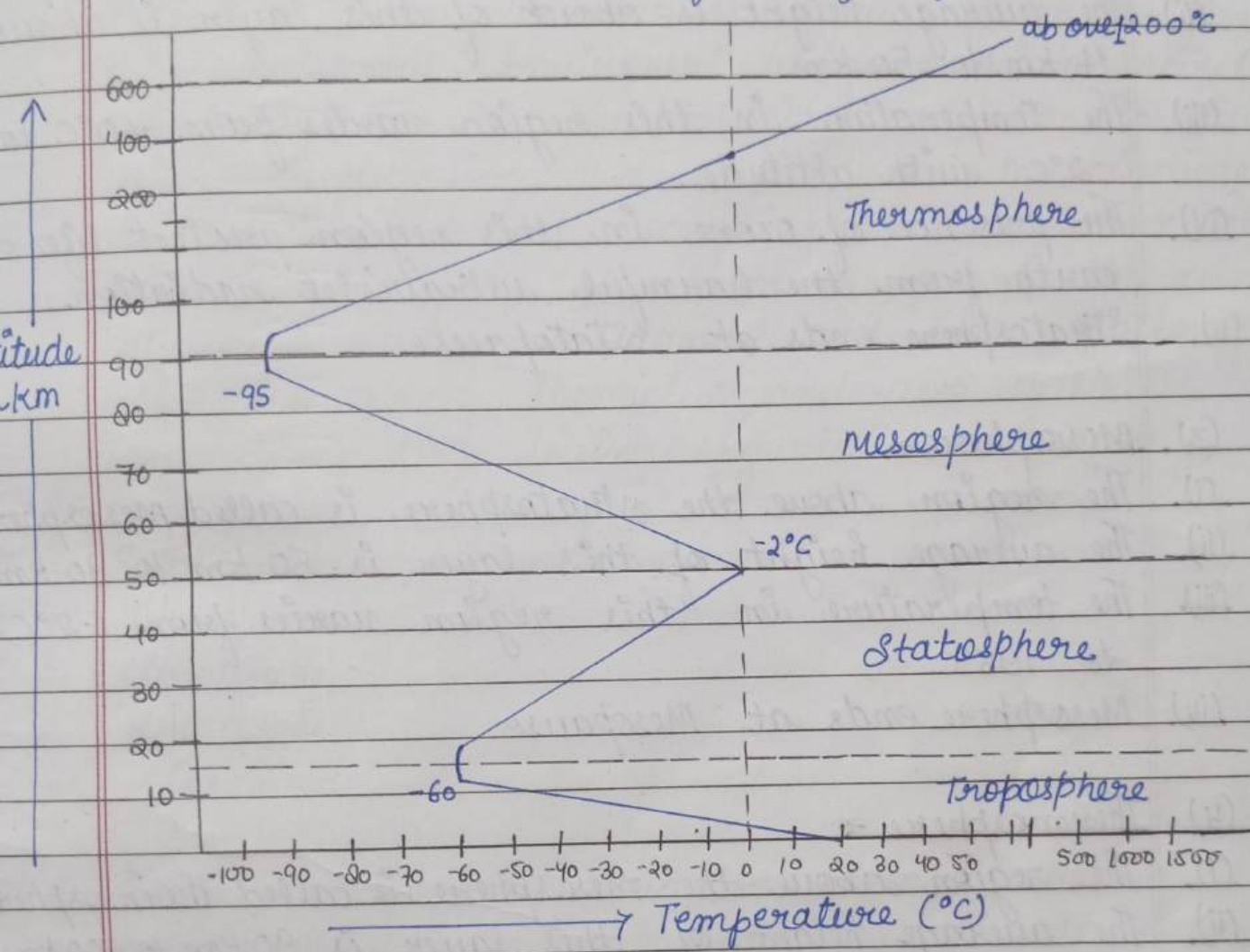
Structure of Atmosphere

Atmosphere is the multi-layered gaseous surroundings the earth.

100 km	Exosphere
500	Thermosphere
90	Mesosphere
50	Stratosphere
14	Troposphere
0	

Earth Surface

Depending upon the temperature an altitude. The atmosphere is divided into following regions / layers.



(1) Troposphere

- (i) The lower most layer of atmosphere in which living organisms exist is called troposphere.
- (ii) The average height of this layer from earth surface is about 14 km.
- (iii) The temperature in this layer (region) varies from 20°C to -60°C with altitude.
- (iv) Troposphere ends at Tropopause.



(2) Stratosphere →

- (i) The region above the tropopause is called stratosphere.
- (ii) The average height of this layer is about 14 km to 50 km.
- (iii) The temperature in this region varies from -60°C to -2°C with altitude.
- (iv) The presence of ozone in this region protect life on earth from the harmful ultraviolet radiation.
- (v) Stratosphere ends at Stratopause.

(3) Mesosphere →

- (i) The region above the stratosphere is called Mesosphere.
- (ii) The average height of this layer is 50 km to 90 km.
- (iii) The temperature in this region varies from -2°C to -95°C .
- (iv) Mesosphere ends at Mesopause.

(4) Thermosphere →

- (i) The region above the mesosphere is called thermosphere.
- (ii) The average height of this layer is 90 km to 500 km.
- (iii) The temperature in this region varies from -95°C to above 1200°C .
- (iv) Thermosphere ends at Thermopause.

(5) Exosphere → From previous note



Scope of Environment Studies

Definition → Environment is derived from the french word "Environer" which means to encircle or surrounds. All the biological and non-biological things surrounding, and organism are thus included in an environment. According to environmental protection act (EPA) 1986. Environment is the sum of total water, air and land interrelationship between among themselves and also with the human beings, other living organism and property.

Four major component →

- 1- Atmosphere
- 2- Lithosphere
- 3- Hydrosphere
- 4- Biosphere

Earth surface are distributed among four major environmental compartment conceptual spheres. Atmosphere, Lithosphere, Hydrosphere, Biosphere.

Types of Environmental →

Environment can be divided into two category:-

- (1) Natural Environment → The environment that terms in its existence by naturally without the influence of human beings is called as natural environment.

(2) Man-Made Or Anthropogenic Environment

The environment which has been have been modify by human activities is called man-made environment. Ex → Some specific area, temperature, humidity

Components of environment

(1) Atmosphere → The atmosphere surrounds the earth and protect by blocking out dangerous rays from the sun. The atmosphere is a mixture of gases that becomes thinner until it gradually reach space. It is composed of nitrogen 78%, Oxygen 21%, and other gases 1%.

The earth atmosphere contain several different layer that can be defined according to the air temperature. According to the temperature, the atmosphere contain four different layer. The first layer is called the atmosphere. The depth of this layer varies from about 8 to 16 km.

Ecology → Ecology is the Greek word made up of two words -

Oi Kos + Logos meaning of Oi Kos is habitation habitation means home. Logos means study.

Ecology is the relationship among living organisms including human beings and their physical environment.

Ecology consider organisms at the individual, population, community, ecosystem and biosphere level.

The word Ecology was first ^{coined} by 'Ernest Haeckel' but defined by Alexander Van.

Ecology overlaps with closely related sciences of biogeography, genetics and natural history. Ecology has practical applications in conservation biology, wetland management, natural resource management and human social interaction. Father of ecology in India is 'Ramdev Mishra'

Prof. Misra

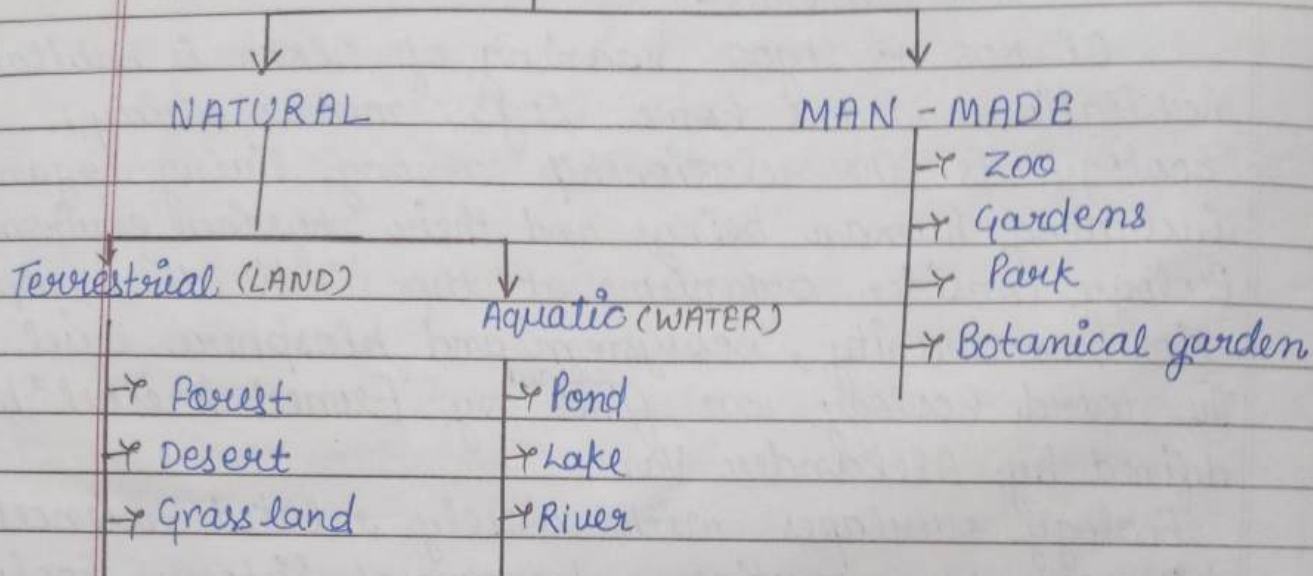
Ecosystem →

An Ecosystem is defined as a community of life forms in concurrence with non-living components interacting with each other.

An ecosystem is a structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words an ecosystem is a chain of interactions between organisms and their environment. The term ecosystem was first coined by 'A. G. Tansley'

Tansley

Types of Ecosystem →



Structure of Ecosystem

The structure of ecosystem consist of two main components-

- 1- Biotic
- 2- Abiotic

(i) Biotic Component → Biotic component refers to all living component in an ecosystem.

Based on nutrition, biotic component can be categorised into autotrophs, heterotrophs and decomposers

(ii) Abiotic component → Abiotic component are the non-living component of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature

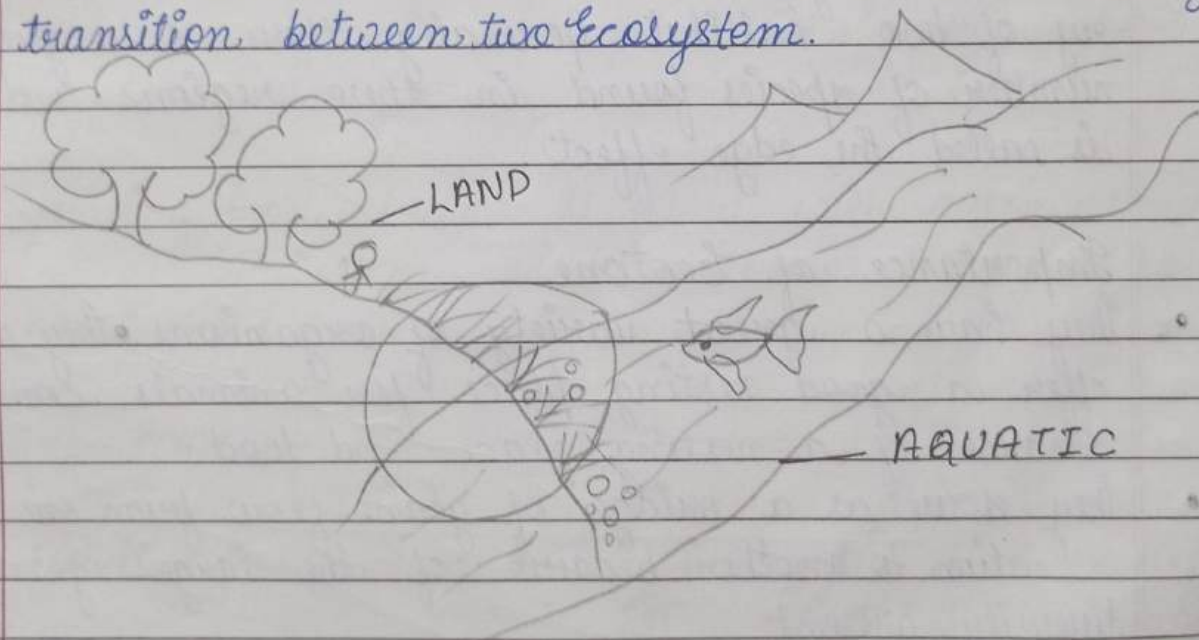
Functions of Ecosystem →

The functions of Ecosystem are as follows-

- (1) It regulate the essential ecological process, supports life system and renders stability.
- (2) It is also responsible for the cycling of nutrients between biotic and Abiotic component.
- (3) It maintains a balance among the various trophic levels in the ecosystem.
- (4) It cycles the minerals through the biosphere.
- (5) Abiotic component helps in the synthesis of organic components that involves the exchange of energy.

Ecotone

An ecotone is an area that act as a boundary or transition between two Ecosystem.



A common example could be an area of marshland between a river and river bank. Ecotones are of great environmental importance because the area is a transition between two ecosystem, it is natural that it contains a large variety of species of flora and fauna as the area is influenced by both the bordering ecosystem.



characteristics of ecotone

- (1) It may be wide or narrow.
- (2) It is a zone of tension.
- (3) It could contain species that are entirely different from those found in bordering system.
- (4) Ecotones can be natural or man-made. For ex. the ecotone between an agricultural field and a forest is a man-made ecotone.

Edge Defect Effect

Edge effect refers to the change in population or community structure that occurs at the boundary of two habitats. Generally, there is a greater number of species found in these regions and this is called the edge effect.

Importance of Ecotone

- They have a great variety of organisms. They also offer a good nesting place for animals coming in search of a nesting place and food.
- They serve as a bridge of gene flow from one population to another because of the larger genetic diversity present.
- They can act as a buffer zone offering protection to the bordering ecosystem from possible damage.
- Ecotones are also a sensitive indicator of global climate change. A shifting of boundaries between ecosystem is thought to be due to climate change. So scientist and environmentalist are studying with great interest.



Food Chain

Within an ecosystem nutrients are recycled as living things go about their daily business of eating food and excreting waste product. All living things exist as part of a nutrient recycling chain defined by what eat what? this is called food chain.

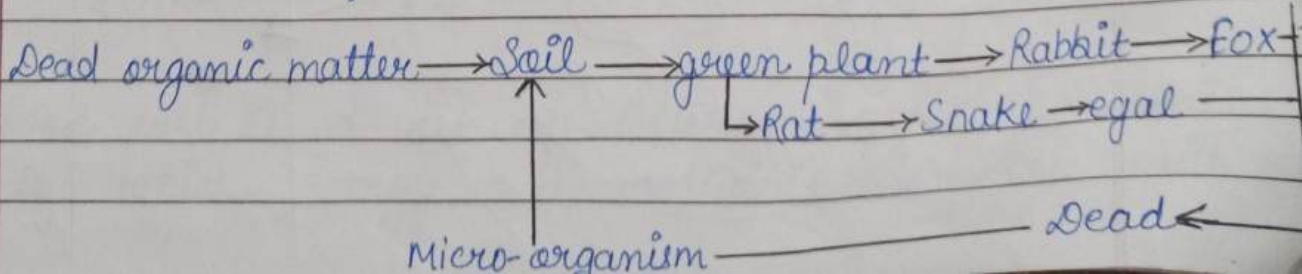
The transfer of food energy from the producer to the higher level consumer through a series of organisms constitutes food chain. All organisms are living or dead are potential food for some other organisms and thus there is essential no waste in functioning of natural ecosystem.

Three basic type of food chain are found in are typical ecosystem through which energy assimilated by plant can flow.

- (1) Grazing food chain:- It start with green plants and via herbivorous transfers to carnivorous.

PLANT → RABBIT → FOX

- (2) Detritus food chain:- This integrated dead bodies of plants is called Detritus. A group of minute organisms for which detritus serve as a source of energy are called Detritivores the food chain in so form is called detritus food chain.





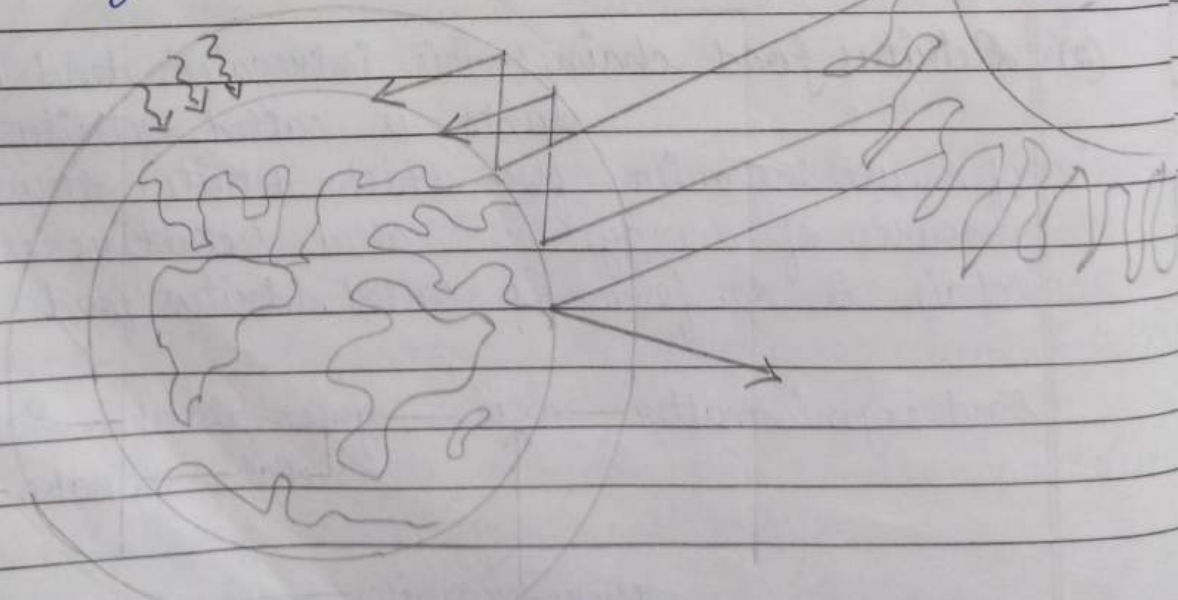
- (3) Parasitic food chain - In parasitic food chain, either the producer, or consumer, is parasite therefore food passes to smaller organisms.

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 this atmosphere. Radiatively active gases in a planet's atmosphere radiate energy in all directions part of this radiation is directed towards the surface, warming it. The intensity of the downward radiation - that is, the strength of the greenhouse effect - will depend on the amount of greenhouse gases that the atmosphere contains.

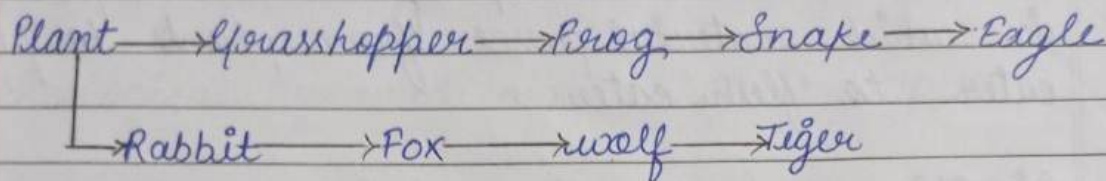
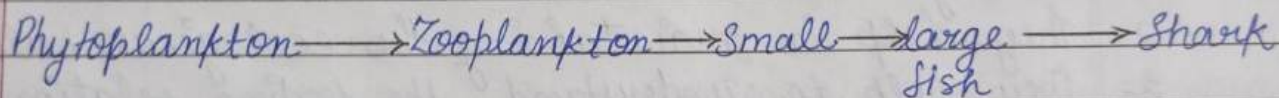
Causes of greenhouse effect:-

- * Burning of Fossil Fuels.
- * Deforestation.
- * Farming.

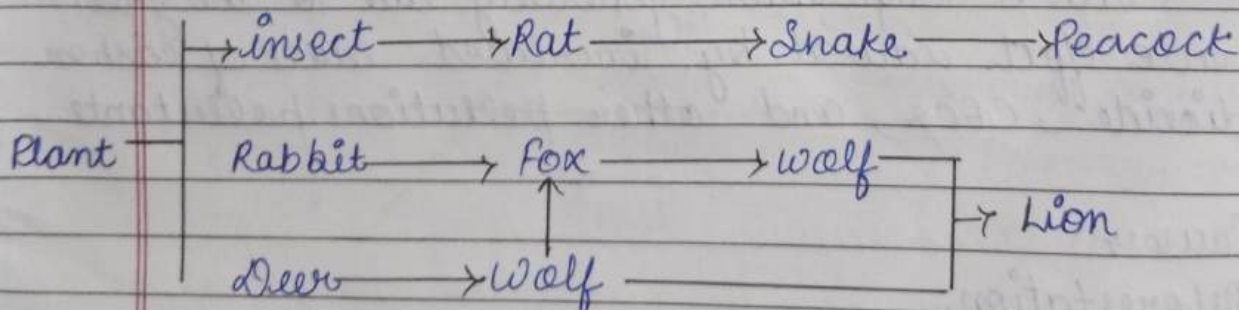


Types of Greenhouse gases -

- ① Carbon dioxide (CO_2)
- ② Methane (CH_4)
- ③ Nitrous oxide (N_2O), and Industrial gases.

(4) Terrestrial food chain -(5) Aquatic food chain -Food web

Food web is the network of food chains where different type of organisms are connected at different trophic level. So, that there are a number of options of eating and being eaten and each trophic level.



Food web is a set of interconnected food chains by which energy and materials circulate with



in an ecosystem the food web is divided into two broad categories -

- (1) The grazing web - which typically begins with green plants, algae.
- (2) Detrital web - which begins with organic debris. These webs are made up of individual food chains in which material passes from plants to plant eater to flesh eater.

Significance, food chain, and food web

- 1- The energy flow and nutrient cycling take place through them.
- 2- They help in maintaining the ecological balance.
- 3- They help to understand the feeding relationship and interaction between organisms in an ecosystem.
- 4- Food chains show a unique property of biological magnification of some chemicals.

Global Warming

Global warming is a gradual increase in the earth's temperature, generally due to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other pollutants.

Causes

- * Deforestation
- * Agriculture
- * Volcanoes

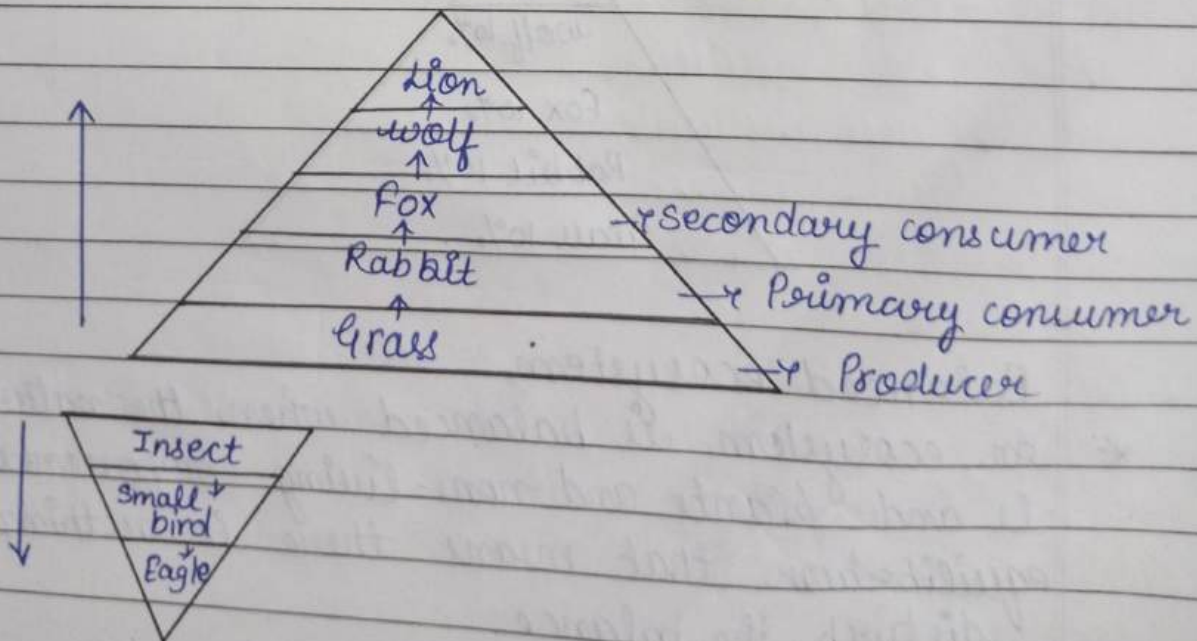
* overpopulation

Ecological Pyramid

Graphical representation of trophic structure and function of an ecosystem starting with producer at the base and successive trophic levels forming the apex is known as the ecological pyramid.

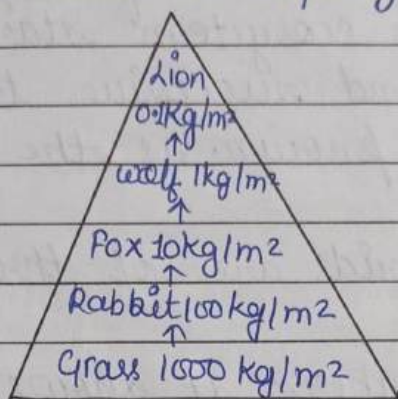
Ecological pyramids are of three types:-

- (1) Pyramid of number - It shows the relationships among the number of producers primary consumers (herbivore), secondary consumers (carnivore) and so on in any ecosystem.
- (2) It also represents the number of individual organism per unit area at each trophic level represent.
- (3) We may have upright and inverted pyramid of number depending upon the type of ecosystem.



(ii) Pyramid of Biomass

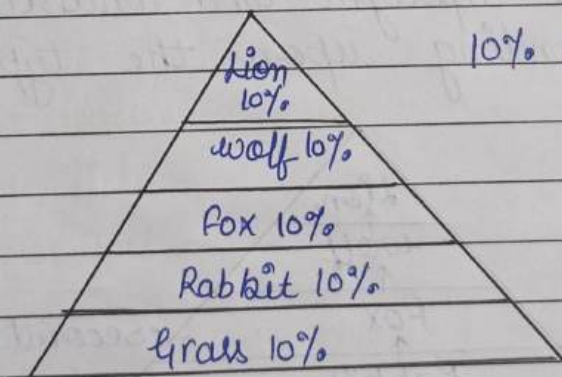
It is based up on the total biomass at each trophic level. in food chain the pyramid of biomass can also be upright and inverted.



(iii) Pyramid of Energy

The amount of energy present at each trophic level is considered as the pyramid of energy.

* Pyramid of energy gives the best representation of trophic relationship.



10% energy transferred

Balanced ecosystem.

* An ecosystem is balanced when the natural animals and plants and non-living components are in equilibrium that means there is nothing to disturb the balance.

* In an aquatic ecosystem rocks are needed for shelter and plants provide oxygen for fish.

* With increasing pollution change in migratory patterns and rise of human population cause many ecosystems are in danger of losing their harmony.

chapter - 3Effect of Human Activities on Environment

Humans exploit their surrounding for the resource they need to survive.

Our current exploitation of birds, however is greater than those of most species for three main reasons - technology, population and consumption.

Human activity can impact land use on small scale or create such bigger problem as habitat fragmentation. These changes can introduce a chain of change in copying strategy therefore altering pattern in the environment.

Pollution

Pollution is any undesirable change that takes place in the environment which is harmful to both living & non-living.

Types of Pollution

- 1- Air pollution
- 2- Water pollution
- 3- Soil pollution
- 4- Noise pollution

(1) Air Pollution → Air pollution refers to the release of harmful gases into the earth's atmosphere.
Eg → Burning fossil fuels, Mining operations.

- (2) Water Pollution → Water pollution is said to occur when toxic pollutants are introduced into water bodies. Example - Dumping solid waste in water bodies.
- (3) Soil Pollution → Soil refers to the degradation of land due to the presence of chemicals in the soil. Example - Improper industrial waste disposal.
- (4) Noise Pollution → Noise Pollution refers to the excessive amount of noise in the surrounding that disturbs the natural balance. Example - Noise from social events, heavy machine noise.

Food

Food is any substance that is usually composed of carbohydrate, fats, protein and water that can be eaten or drink by animals and humans for nutrition. Items considered food may be sourced from plants animal and other categories such as fungus or fermented food.

Plant and animal are the main source of food for human beings for example wheat, rice, oats, sweet potato, pulses, millets, sugarcane. The majority of food consumed by human beings is seed waste. Example - beans, rice, maize, wheat

Many plants have evolved fruit that are attractive as a food source to animals so that animals eat

fruits and excessive the seeds at some distance away from the source plant. Animal can be used as food directly or indirectly meat is an example of direct product taken from animals while eggs, honey, milk are indirect product.

World food Problem

During the last 50 years global grain production has increased almost three times three by increasing per capita production by about 50 percent but at the same time population growth has increased at ~~an~~ such a rate in less developed country. I.e, out stripped food production world food problem is majorly classified under three categories, undernourishment, malnutrition, over nutrition.

Undernourishment

Undernourishment is the lack of sufficient calories in available diet according to food and agriculture -l organisation the average minimum, daily, caloraphic are said to be undernourished.

One more severe condition undernourishment is serious undernourishment in which people take less than 80 percent of their daily caloraphic value

Malnutrition

Malnutrition is the lack or deficiency of specific constituents of food such as protein;



vitamin or certain essential element.

Overnutrition

Overnutrition result from eating too much eating too many wrong things, not exercising enough, taking too many vitamins or other things.

* Shelter

where a person lives matters since both natural and built environment influence health.

Physical Environment → can also contribute to health inequality particularly climate are expected to place increased health burden on society and infrastructure.

* Outdoor air pollution causes health effect such as asthma or respiratory diseases. It also causes cardiovascular diseases.

Built Environment → the environment can influence physical and mental health. through factor such as community design, adequate housing, availability of safe water, safe neighbourhoods and child care.

* the built environment can provide opportunity for social interaction through an array of social/network generally the large urban centre, the greater the number and complexity

of social network, social arrangement in the community build trust, efficiency and a sense of belonging, i.e., associated with improved mental health

* Although urban areas provide many opportunities for social contact with others

* Housing

The way in which a house is built, maintained and used has a significant and immediate impact on the environment. The location of any new development and its relationship to the existing development are important in minimizing its effect.

(1) Use of non-renewable resources

Policies governing the design, construction and renovation of housing do not impose any requirement through registration, legislation, regulation to minimize the use of non-renewable resources.

(2) Energy consumption

Energy consumption in houses accounts for significant percentage of the total energy consumption each year.

(3) Water consumption. - Two thirds of water is used to flush water closet, wash clothes or dishes and for bathing. Except when there are water shortage there is no expectation that households will conserve or recycle water. There is no consumer



expectation from house builders to design homes in ways that conserve water.

Neighbourhood

All neighbourhood have an ecological footprint. Neighbourhood which are most compact and self contained with more local shopping, employment and community facilities smallest footprint. One implication of this is a potential reduction in dependence of private vehicle.

- Reducing the need of private vehicle makes significant contribution to more sustainable neighbourhood.

* Agriculture

Green Energy use Agriculture.

The impact of agriculture on biodiversity - genetic species and ecosystem has emerged as an important environment issue.

Green House gases

Land use & Agriculture contribute to green house gases increase through land use in four main ways -

- 1- Carbon dioxide releases linked to deforestation.
- 2- Methane releases from rice cultivation.
- 3- Methane releases from fermentation of solid waste
4. Nitrous oxide releases from fertilizer application

Effect of Modern Agriculture.

It makes use of hybrid seeds of selected and single crop variety, hitech equipment and lots of energy in the form of fertilizers, pesticides and irrigation water. however it also gave rise to several problems such as -

- 1- Impact related to high yielding varieties.
- 2- Fertilizer related problem
- 3- Nitrate Pollution
- 4- Eutrophication
- 5- Creating resistance in pests and producing new pests.
- 6- Death of non-target organism.

Industries

- * Industry is essential for development of country and prosperity of peoples but industrial process and production causes major problem for all living beings
- * Air pollution is visible source of environmental contamination created mainly by industries waste product and combustion of hydrocarbons
- * Chemical rises from many sources, they are widely used in day to day household and work place activities, from vehicle emission
- * As well as from industrial output beside depleting natural resources they generate air borne emission after influent and solid waste leading to climate change.



Mining

Mining is the extraction of minerals and metals from earth. Mining provide iron for steel making, salt for food, coal for fuel are example of extraction process. There are many method of mining dependent on where and how minerals are extracted.

Deforestation

Deforestation refers to the decrease in forest across the world that are used for other uses such as agricultural croplands, urbanization or mining activities.

Causes of Deforestation:

- Deforestation caused by new constructions.
- The construction of human infrastructures has also been driving deforestation.
- The populational shift that is leading people to move from rural areas to urban areas is also contributing to deforestation.
- Agricultural expansion.
- Wood extraction (e.g., logging or wood harvest for domestic fuel or charcoal).

Impact of Deforestation

- ★ Major climate change: Increase in temperature and pollution level.
- ★ Increase in the greenhouse gases in the atmosphere.
- ★ Decrease in ground water level.
- ★ Desertification and soil erosion.
- ★ Wild Animals extinction & Environment loss

Chipkoo Movement

The chipkoo movement is a forest conservation movement in India, opposed to commercial logging, and the government's policies on deforestation, protesters in the 1970's engaged in tree hugging wrapping their arms around trees so that they could not be felled.

Water borne diseases:-

(bacterium salmonella typhi)

- Typhoid:- A fever that increases gradually (bacterial infect)
Symptoms:- Muscle ache, fatigue, constipation.
- Cholera:- The infection attacks intestine (vibrio cholerae bacteria)
Symptoms:- Nausea, vomiting, muscle cramps.
- Dysentery:- waterborne disease characterized by severe
Symptoms:- fever, vomiting, dehydration, Diarrhea.
 - It can be caused by bacteria, viruses or parasites in unsafe food and water.
- Hepatitis A: Hepatitis A is a liver infection caused by consuming contaminated food and water or by coming in close contact with someone who has the infection.
Symptoms - Fatigue, loss of appetite, sudden fever
 - caused by hepatitis A virus (HAV)
- Giardia:- waterborne disease is shared through contaminated water. The infection is caused by a



parasite and typically clears up w/in a few weeks.

Symptoms - weight loss, Diarrhea, Nausea, cramps and bloating, Abdominal pain.

- Caused by flagellate protozoan *Giardia Intestinalis* (famously known as G lamblia)

Effect of Mining

- * It is one of the main cause of deforestation. In order to mine trees and vegetation are cleared.
- * Stripping of large area of top soil and of all flora in addition to man made construction under ground coal mining require the removal of an entire layer of material deep under the surface.
- * Many mines require tailings dam to prevent waste being washed into the river.
- * Asbestos Mining causes the dispersion of asbestos into the environment this will cause death of local workers after a long period of time.
- * Digging up of chemically reactive minerals which are harmless when underground but when exposed react with oxygen and water present over the surface of soil causes health hazard.
- * Environmental issues can include erosion, formation of sink hole and loss of bio diversity.

Transportation

Transportation is an important dimension of concept of sustainability which is expected to become the prime focus of transport in upcoming years.

From one side transportation activities support increasing mobility demands for passenger and this ranging from urban areas to international trade.

On the other side transportation activities have result in growing level of congestion.

Impact of Transportation Activities

Direct Impact

The immediate effect of transportation activities on the environment.

Indirect Impact

The secondary effect of transport activities on environment system.

Cumulative Impact

The additive, multiplicative effect of transportation activities.

Transport Infrastructure and the operation of vehicle can impact the rural and urban area also.

Socio Economic characteristic India's diverse economy encompasses traditional based farming modern agriculture handcraft and wide range of industries.

Natural Resources

India's major mineral resource includes coal, iron, magnes, limestone and natural gases rising energy demand increases with economic

growth has created a problematic state of energy. India is poor in oil resource and is currently dependent on coal and foreign oil import. India is rich in certain energy resources (Thorium) which promise significant future potential.

Environmental Impact Assessment (EIA)

Environment Impact Assessment is a tool that seeks to ensure sustainable development through the evaluation of those impacts arising from a major activity that are likely to have significant environmental effect.

An EIA is an assessment of the possible impact (Positive or Negative) that a proposed project may have on the natural environment.

The International Association for Impact Assessment defines an environmental impact assessment as the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of development proposals prior to major decisions being taken and commitment made. EIA experience in India indicates that the lack of timely availability of reliable and authentic environmental data has been a major difficulty in achieving the full benefit of EIA.

Procedure →

- Project proposal → the project proposal shall include all relevant information available including a land use map in order to move the next stage.

- Screening & Screening is done to see whether a project requires environmental clearance as per the statutory notifications.
- Consideration of Alternative → It has to be done by consultant in consultation with the project guidance, if need be, from impact assessment agency. The ministry of environment and forest has published guidelines for different sectors which outlines the significant issues to be addressed in the EIA studies.
- Based line data collection → Based line data describe the existing environmental status to the identifying study area.
- Impact prediction →
Impact prediction and Assessment of alternative :-
 Impact prediction is the way of mapping the environmental consequences of the significant aspects of the project and alternatives.
- EIA Report → An EIA report should provide clear information to the decision maker on the different environmental scenarios without the project, with the project alternative.
- Public Hearing →
 After the completion of EIA report the law requires that the public must be informed and consulted on a proposed development after



the completion of EIA report. Anyone, likely to be affected by the proposal of project is entitled to have access to the executive summary of EIA.

- Decision making → Decision making process involved consultation between the project proponent and the impact assessment authority.
- Monitoring the clearance condition → Monitoring has to be done during both construction and operation phase of project. It is done not just to ensure that the commitment made are complied with but also to observe whether the prediction made in EIA is true.

Sustainable Development

Sustainable development is defined as meeting the needs of present without compromising the ability of future generation to meet their own needs. The necessary conditions for achieving sustainable development are →

- * Social Equality → There should be an equilibrium condition in the society among the same generation within, and between nations, and between two different generation.
- * Economical Equality → The technology should address to the problem of developing countries, producing doubts for uncertain climate, vaccines for different diseases.



* Ecological security - If any development process protect our biodiversity decreases the rate of soil erosion and increases the forest cover that brings ecological security.

* Objectives of sustainable development

- It should protect our biodiversity.
- It should prevent soil erosion.
- It should slow down the pollution growth.
- It should increase forest cover.
- It should cut-off the emission of CFC, SO_x, NO_x.
- It should reduce waste generation.

How to achieve sustainable development

- Effective use of water.
- To reduce the wastage of water, we can use water meter technique.
- ~~By~~ Reducing deforestation.
- ~~Not~~ - use of renewable resources - wind energy, solar energy, thermal energy.

Natural Resource

The word resource means a source of supply or support that is generally held in reserve. In other word the natural resource are the material which living organisms can takes from nature for the substance of their life.

Depending upon the availability of natural resources are of two type.

1. Renewable and 2. non-renewable.



- 1- Renewable sources are in-exhaustible in nature and can be regenerated within some span of time. For example - Solar energy, thermal energy, wind energy.
- 2- Non renewable resources which cannot be regenerated once if they are used. For example - such as petroleum, minerals, coal.

Water Resource

Water is needed daily use by living organism for irrigation, industrial use, electricity production and domestic use.

On the earth nearly 97% of water is available from which only 3% of water is used by living beings for their livelihood. At present about 25% per of the ground water is being used by man.

The water of the rivers and lake it is not absolutely pure even the water coming out from earth (underground water) is also have some impurities.

Water mainly contained by carbonates, sulphate, sodium, magnesium and potassium as contaminant which disturbs the natural property of water.

Water is characterised by certain unique features which make it ultimate resource.

It exist as liquid over a wide range of temperature (0°C to 100°C)

It has the highest specific heat that is how much energy is needed to increase temp. of 1 gm of substance to 1° .



- # It has high latent heat of vaporization.
- # Due to high surface tension and cohesion it can easily raise through great height stems, even in the tallest tree.
- # It is an excellent solvent for various nutrient.
- # The temperature density relationship of water is unique.

Source of water -

Source of water are broadly classified as surface source and sub-surface source.

Example - Lake, river, ocean etc.

Sub-surface example - Aquifer, Drainage well, Tube well etc.

Water-Born disease -

Polluted water causes severe health issues. If it is taken by living organisms. Contaminated drinking water used in the preparation of food can be the source of food-borne disease through consumption of some micro-organisms. Disease caused by unhealthy water are such as Typhoid, dysentery, cholera.

Disease	Caused by
Cholera	Vibrio cholerae bacteria
Typhoid	Salmonella typhi
Hepatitis A	Hepatitis-A virus
Polio	Polio

Prevention

Clean water is required for reducing the spread of water borne disease. It is well recognized that the prevalence of water borne disease can be greatly reduced by provision of clean water with the help of disinfection. We can achieve clean water for livelihood. The process of disinfection can be achieved by filtration of water or by giving some pre and post treatment such as chlorination or by boiling the water.

Without disinfection the risk from water borne disease is increased.

FluorideChloride. Problem in drinking water.

Fluoride is one of the chemicals that has been shown to cause effect in drinking water to the people.

Fluoride has beneficial effect on teeth at low concentration.

(1 mg per litre) but excessive exposure to fluoride in drinking water can give rise to adverse effect. Fluoride is found in all natural water at some concentration. However low or high concentration of fluoride can occur in ground water depending upon the nature of rock.

* Effect on human

- 1) Its effect on teeth. High level of fluoride present in
- 2) Its concentration upto 10 mg/l were associated with dental fluorosis. While low level of fluoride less than 0.5 mg/l causes dental decay.

* Skeleton Effect & Skeleton fluorosis is primarily associated with consumption of drinking water containing elevated level of fluoride. (5mg/l)

* Ways to Remove fluoride from water &

(i) Reverse Osmosis &

- It is very expensive process.
- This is used to purify several type of bottled water.

(ii) Activated alumina defluoridation method &

These filter are used in local areas they are relatively expensive and require frequent replacement.

(iii) Distillation filter &

They are commercially available distillation filter that all use to remove fluoride.

Arsenic problem in drinking water

Arsenic^{As} occur ^{naturally} in rocks and soil in number of countries. The drinking water standard for arsenic is 10ppb. There are two primary form of arsenic.

- (1) Inorganic arsenic
- (2) Organic arsenic

Inorganic arsenic - Arsenic combined with hydrogen, oxygen, chlorine and sulphur

Organic arsenic & Arsenic combined with carbon

It is found in animal and plants.

Source of arsenic contamination in drinking



water. The greatest threat to public health from arsenic originated from contaminated ground water, drinking water, crops irrigated with contaminated water are the source of exposure.

Arsenic can come from some human activities also such as mining waste from industries processing of glass, metal adhesives, pesticides, pharmaceuticals etc. If these industrial waste contaminated with ground water, they can increase arsenic content in water.

Effect of Arsenic in Human Health

Short term exposure to very high level of arsenic may cause stomach pain, nausea, vomiting, headache and even death.

Long term exposure to arsenic from drinking water and food can lead to chronic arsenic poisoning and may result cancer of bladder, lungs, liver, kidney and this discolouration of skin. It has also been associated with cardiovascular diseases such as blockage of veins.

Prevention and control

- 1) It can be prevented by the provision of safe water supply for drinking.
- 2) Long term action are also required to reduce occupational exposure from industrial process.
- 3) Education and community engagement are key factors for ensuring successful intervention.

Mineral Resources

Minerals are naturally occurring, inorganic, crystalline solid having a definite chemical composition and characteristic physical property. Most of the rock we see every day are just composed of few common minerals such as quartz, dolomite, feldspar, calcite.

* Classification of minerals in India

The number of minerals mined in India can be grouped as fuel minerals, metallic minerals, or non-metallic minerals. Examples ↗

→ fuel → coal, petroleum, kerosine, natural gas.

→ metallic → iron ore, chromium ore, copper ore, Bauxite ore.

→ non-metallic → lime stone, dolomite, clay.

* Uses and exploitation

The main use of minerals are as follows.

- 1) Development of industrial plant and machinery.
- 2) Generation of energy.
- 3) Construction, housing, settlement.
- 4) Defence equipment.
- 5) Means of transport.
- 6) Medical system.
- 7) Formation of alloys for various purposes.

For

* Conservation of mineral resources

- (1) Minimizing waste and developing technologies to recover the resources from waste.
- (2) Developing technologies to recycle metals.



- (3) Mining area need to be reclaimed alternative of fossil fuel need to be found
- (4) Development of alloy which will reduce the demand of some pure metal

Material cycling

Recycling nutrient in the ecosystem is important because only plant can create new nutrient by combining molecules from soil and air. Other members of the food chain reuse the nutrient assembled by the plant. Nutrient like carbon, nitrogen, sulphur etc. moves in the circular path through biotic and abiotic component are therefore known as biochemical cycle. Water also moves in a cycle known as water cycle or hydrological cycle.

Nitrogen cycle

Nitrogen is an essential element of DNA and RNA and protein. Although the majority of air we breathe is nitrogen (N_2) most of the nitrogen in the atmosphere is unavailable for use by organisms. All the living organisms except plants nitrogen gas cannot be used by them directly in the rock form. To use nitrogen it must first be converted into more stable form such as Ammonia, nitrate or organic nitrogen.

The conversion of nitrogen to nitrate it means conversion of nitrogen to nitrate into a stable state is known as nitrogen cycle.

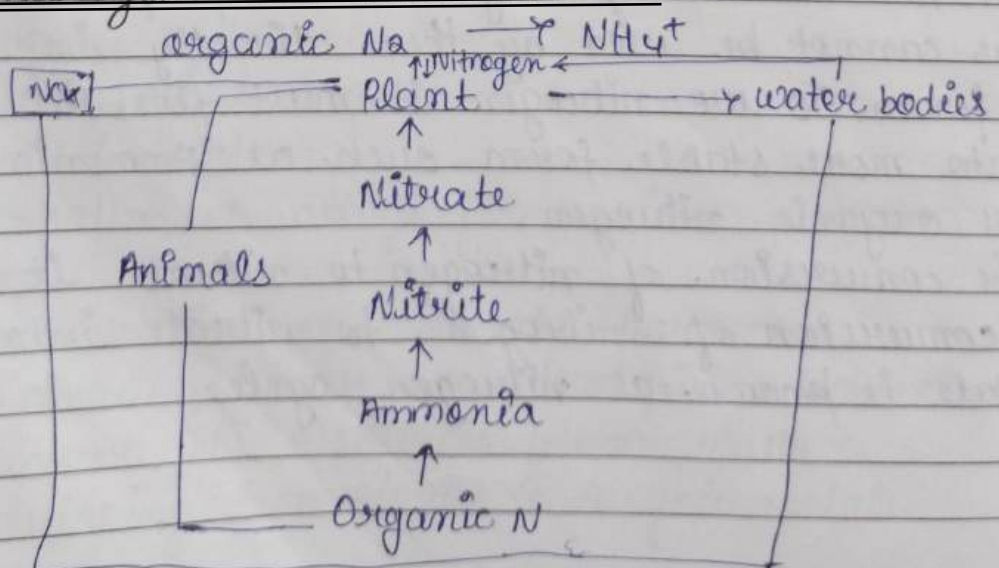
Nitrogen Fixation

Nitrogen fixation is the process where nitrogen is converted into ammonium. It is essential process because it is the only way that organisms can attain nitrogen directly from the atmosphere. Rhizobium is the bacteria which is used for nitrogen fixation through metabolic process. Nitrogen fixing bacteria have symbiotic relationship with host plant. In this relationship nitrogen fixing bacteria inhabit legume roots nodules and receive carbohydrate a favourable environment from their host plant in exchange for some of the the nitrogen they fix. The bacteria which exist without plant host are known as free living bacteria (free living nitrogen fixers).

Nitrogen uptake

The ammonia produced by nitrogen fixing bacteria is usually incorporated into protein or other organic nitrogen compound. $NH_4^+ \rightarrow$ organic N_2

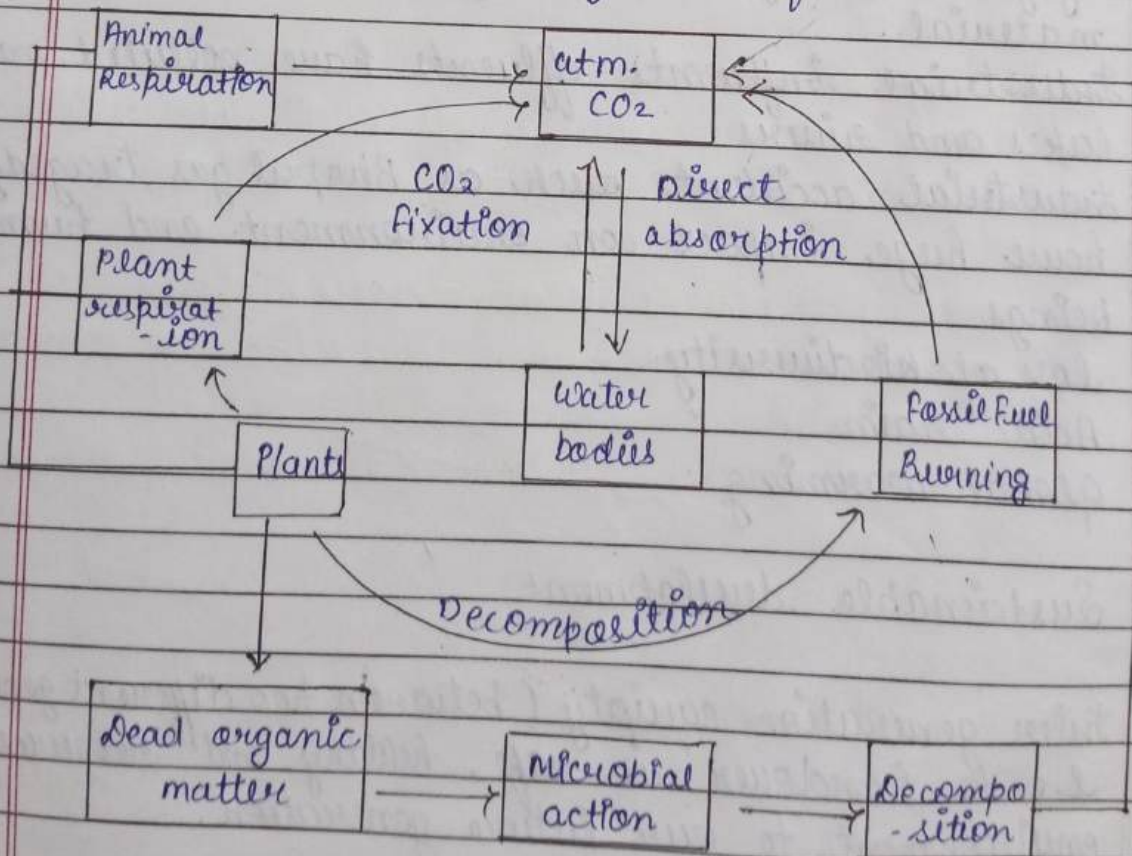
* Nitrogen mineralization



Carbon Cycle

Carbon is the basic building element of all the living organisms by volume in atmosphere CO₂ is present in the minimum amount (0.03%) It is observed by the plant in the form of CO₂ for the process of photosynthesis from both the producers and the consumers carbon is returned back to the atmosphere during respiration after the death of producer and consumer certain decomposition agent like bacteria and fungi decomposes and degraded the complex organic compound in the form simplest form.

Thus carbon cycle is maintained by the process of photosynthesis, respiration and decomposition and also some part of burning fossil fuels.





CO₂ has the unique property of absorbing infrared rays of the sun, thus keeping the earth warm. But a huge amount of CO₂ has been released into atmosphere due to extensive industrialization. This has resulted in an excessive absorption of infrared radiation, which causes increase in atmospheric temperature. A green house effect is experienced by this effect.

Energy Resource

Effect of transportation on Environment

- 1) Industrial practices release huge quantities of air and water pollution.
- 2) They generate huge amount of hazardous waste material.
- 3) Industrial influents effluents have polluted many lakes and rivers.
- 4) Industrial accidents such as Bhopal gas tragedy have huge impact on environment and human beings.
- 5) Loss of biodiversity.
- 6) Acid rain.
- 7) Global warming.

Sustainable development

- (1) Inter generation equity (between two different generations) i.e. to handover a safe, healthy and resourceful environment to our future generation.



- (d) Intra generation equity → There should be balanced condition in the society and the same generation within an between nation.
- For example → technological development ^{will} support the economical growth of the poor countries and help in narrowing the gap between different nations.

Measures of sustainable development →

- # To adopt 3R (Reduce, Reuse & Recycle) approach.
- # Promoting environmental education and awareness.
- # To utilize resources as per the carrying capacity of the environment.
- # Improving quality of life, including social, cultural and economic dimension.

Unit - 3 Environmental Pollution

Environment + Pollution can be defined as undesirable change in the physical, chemical, or biological characteristics of any component of the environment which can cause harmful effects on various form of life or property.

Pollutants + Pollutants are the materials or factors which cause adverse effects on the natural quality of any component of the environment is known as Pollutants

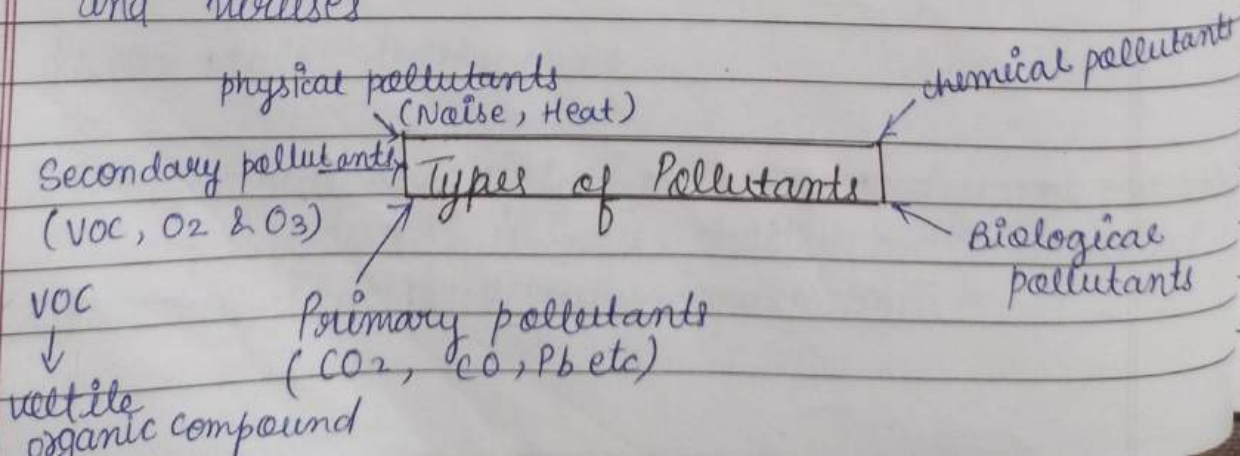
or

these substances that create pollution are called pollutants

Types of Pollutants +

On the basis of nature or of Pollutants it can be divided into following three types.

- (1) Physical Pollutants + Heat, noise, odour etc
- (2) chemical Pollutants + They includes carbon monoxide [CO], Cd, Cr, gases etc.
- (3) Biological Pollutants + Microorganisms like bacteria and viruses





Primary Pollutants → Pollutants that enter directly from the sources into the atmosphere are called primary pollutants.

Secondary Pollutants → Pollutants that are formed due to interactions between primary air pollutants and other atmospheric components are called secondary pollutants.

Water Pollution → Water pollution shows the addition of foreign substances from natural/anthropogenic may be harmful to life because of their toxicity, reduce normal oxygen level of water and spread diseases.

Sources of water Pollution → The main sources of water pollution are given below.

- (1) Sewage → Emptying the ~~trains~~ drains and sewer into water bodies causes water pollution.
- (2) Industrial effluents → Industrial waste containing toxic chemicals or radioactive substances causes water pollution.
- (3) Agrochemicals → Agrochemicals like fertilizers and pesticides washed by the rain water and runoff to create water pollution.
- (4) Oil spillage/leakage → Oil spillage/leakage into sea water during drilling and shipment.

(5) Waste heat → Waste heat from industrial discharge increase the temperature of water bodies and effects distribution and survival of sensitive species.

(6) Ground water Pollution → Industries, mining, septic tank, etc are mainly responsible for ground water pollution.

Heavy metals (HMS) like Pb, Cr, Cd, Hg etc are the main sources of many industries causing serious health hazards

Effects of Water Pollution →

There are following effects of water pollution are given below

- 1- Sewage water containing many pathogens causing water borne disease.
- 2- Sewage water containing nutrients like N, P, K, etc help in the growth of plant, when they die and decay consume dissolve oxygen of water
- 3- Pollutants such as heavy metals and many other organic and inorganic compounds are harmful to aquatic organisms some heavy metals such as Cd, Cr, Pb and Hg causes various types of diseases.
- 4- The disease called Minamata occurred due to consumption of methyl mercury (MeHg) contaminated fish
- 5- Cd had caused the disease Itai-Itai by cadmium contaminated rice.



- 6- Nitrate when present in excess in drinking water caused Blue baby syndrome or methemoglobinemia.
- 7- Excess of fluoride in drinking water causes fluorosis.
- 8- Arsenic Pollution is causing various types of diseases -

Control of water Pollution

- 1- It is easy to reduce water Pollution from point of sources by legislation.
- 2- Effluents should not be discharge directly into the water bodies, discharging of effluents after proper treatment.
- 3- Proper treatment of sewage water must be done before disposing it into the water bodies. Industrial effluents treatment should be both biological and physical.
- 4- Hot liquid effluents should be cooled before discharge.
- 5- Use of agrochemicals should be minimize.
- 6- Physico-chemical methods like reverse osmosis (RO), ion-exchange zeolite etc should be used to remove water Pollutants.
- 7- Planting of trees would reduce the pollution.

Air Pollution

Air Pollution has been defined as the presence of any solid, liquid or gaseous substance in the atmosphere in such concentration that tend to be harmful to human beings, plants, property, environment and other living creatures.

Sources of Air Pollution

- 1- Air pollutants are substance causing damage to target or receptor. A sources of air pollution are natural (forest fire, marsh gases, volcanic eruptions) and man-made or anthropogenic like vehicle emissions, fossil fuel, and agricultural activities. The rapid increase in air pollution is one of the most important factor of air pollution. And An increasing their ~~is~~ leads to global warming, loss of forest cover, loss of wild life species.
- 2- Rapid cutting of plants, trees and forest has distributed the balance of CO_2 and oxygen O_2 in the nature.
- 3- The measure fossil fuel burning sources are automobiles, thermal power plants and industrial process. The main pollutants ~~emitted~~ emitted are CO , $Ply\ alk$, oxides of sulphur (SO_x), oxides of nitrogen (NO_x)
- 4- The automobile exhaust are responsible for more than 75% of total air pollution due to the release of toxic gases such as carbon monoxide (CO), (NO_x), hydrocarbon and particulate matter.
- 5- fertilizers plants, textile mills, refineries, chemical industries etc. are the major source of toxic gases which cause air pollution.
- 6- Many houses in the developing countries including India use fuel like coal, dung cakes, wood and kerosene in their kitchens due to incomplete combustion of fuels produce the



toxic gases and black soot.

Effects of Air Pollution.

Air pollution has adverse effects on living organisms and materials.

- 1- Sulphur dioxide (SO_2) and Nitrogen dioxide (NO_2) cause respiratory problems.
- 2- Air Pollutants create irritation in the eyes, lungs, nose and throat.
- 3- Suspended particulate matters (SPM) can cause damage to lung tissues and diseases like Asthma and Bronchitis.
- 4- Toxic metals can cause mutations, reproductive problems or even cancer.
- 5- Continuously exposed to air pollution, human become higher risk for cardiovascular disease and affect other vital organs such as kidney and liver.
- 6- Air Pollution directly accelerates the rate of greenhouse gases leading to climate change or global warming.
- 7- Air Pollutants mixing up with rain water and create with the acid rain which can ^{harm} help the humans and plants.
- 8- Presence of sulphur dioxide and moisture can accelerate the corrosion of metallic sulphuric acid.
- 9- Air Pollutants affect plants by entering through plant stomata destroy chlorophyll pigment and affect the rate of photosynthesis.

- (10) Ozone (O_3) in the atmosphere can cause cracking of rubber

Control of Air Pollution

- (1) Setting up of industries after proper environment impact assessment (EIA) studies.
- (2) To minimize the activities which cause air pollution like transportation and energy production.
- (3) Automobile pollution can be checked by regular ~~at~~ basis and replacement of engines of old vehicles.
- (4) installing catalytic converter which reduce air pollution.
- (4) Adopting mass transport system like buses, trains etc.
- (5) Shifting to less polluting fuels like hydrogen gas, methane (CH_4) etc.
- (6) Using non-conventional sources of energy like solar, wind energy etc.
- (7) Planting more trees would reduce air pollution.
- (8) Reduction of air pollution at sources like effluent gases can be absorbed in liquid absorbant.
For ex \rightarrow SO_2 sulphur dioxide absorbed in Ammonia solution (NH_3)
- (9) Devices like cyclone separator, bag filter, wet scrubber, electrostatic precipitator etc. are also available, doubt is for air pollution control.

Noise Pollution

- (1) Sound is mechanical energy from a vibrating source.
- (2) Noise is unwanted, unpleasant or irritating

sound that causes this comfort discomfort is known as noise pollution.

- (3) A type of sound may be pleasant to someone and at the same time unpleasant and unwanted sound is called as noise pollution.
- (4) It is expressed in hertz (Hz) or decibel (dB) and is equal to the number of cycles per second. The central Pollution Control Board (CPCB) committee has recommended permissible noise level for different location as given in table-1.

Area Code	Category of area	Noise level in dB	
		Day	Night
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence zone	50	40

Sources of Noise Pollution

Noise pollution from loudspeakers, factories, aeroplanes, moving trains, construction activities or even radio.

- (1) Industrial operations
Textile, printing processes, metal works etc are major sources of industrial operations.
- (2) Agricultural machines
Tractors, harvesters, tubewells etc.

- (3) Transport vehicles → Air, road and Train transportation.
- (4) Household equipments → Electric home appliances, musical equipments etc.
- (5) Construction → Construction equipments is most major source of noise pollution like mixers, vibrators etc.
- (6) Celebrations → Social / religious functions, election -s etc.

Effect of Noise Pollution →

- (1) Noise level of 50 decibels or more for more than 8 hours a day increase tension.
- (2) Noise pollution above 120 dB can cause many adverse effects like hypertension and chances of heart diseases.
- (3) Muscular strain and nervous break down.
- (4) Continuous exposure to noise for long duration results in damage to ear drum or permanent damage to tympanic membrane cause deafness.
- (5) Noise can disturb sleep.
- (6) It can also disturb the concentration.

Control of Noise Pollution →

- (1) It can be controlled by reducing noise at the sources, interrupting the path of noise.

- (2) Sources of noise pollution, like heavy vehicles, and old vehicles may not be allowed to enter, enter in the populated area or city.
- (3) Noise making machines should be kept in container with sound absorbing media.
- (4) Proper silencing will reduce the noise from machinery.
- (5) Reduction of noise around residential area by planting trees in the form of green belt.
- (6) Reduction of noise from automobiles using silencers.
- (7) Use of sound absorbing materials to reduce noise level. Silencers can reduce noise by absorbing sound. The various types of fibrous materials could be used.
- (8) Use of hearing protection device, like ear plugs, ear muffs etc. they reduce the level of noise.

Solid Waste management.

All solid and semi-solid waste arising from human and animal activities, except human excrete and sullage (liquid wastes from bathroom and kitchen) these are discarded as useless are included in the term solid wastes. The term solid wastes in compasses the highly heterogeneous mass of discarded materials from urban community as well as the more homogenous accumulation of waste generated by agricultural, industrial and mining activities. Solid waste (waste other than liquid or gaseous) can be classified as municipal, industrial, agricult

-weal, medical, mining waste and sewage sludge

Sources of solid waste

Urban waste consist of medical waste from hospitals, municipal solid waste from houses, offices, markets, horticulture waste from parks, gardens etc.

- (1) Domestic waste contains a variety of discarded materials like waste paper, food waste, polythene, kitchen waste, glass water etc bottles etc.
- (2) Waste from markets mainly consists of waste paper, packaging materials, bottles, polythene waste etc.
- (3) Biomedical waste generated by hospitals include disposals, cotton, surgical waste, needles, eye glucose bottles etc.
- (4) Construction waste includes broken stones, iron rod etc.
- (5) Horticultural waste includes vegetable parts, residual plant parts etc.
- (6) Industrial waste consist of large number of materials including factory rubbish, packaging materials, scrap materials etc. etc.

Effects of solid waste

- (1) Municipal solid waste dumps the waste on the road sides due to improper disposal system. This type of dumping allow biodegradable materials to decompose under uncontrolled

Soil pollutants changed its chemical and biological properties of soil and reduce its productivity is known as soil pollution.

Sources of Soil Pollution

- (1) Domestic waste includes garbage, rubbish materials create leachate from dumping, sides and sewage tank are harmful toxic which pollute the soil. ^{Containing} ^{chemicals}
- (2) Industrial waste are the effluents discharge from chemical, leather, ^{cement} industries which pollute the soil and cause soil pollution.
- (3) An increase in the use of agro-chemicals for agriculture increase soil toxicity.
- (4) Soil also receive excreta from animals and humans that contains many pathogenic organisms like bacteria and viruses which cause pollution in the soil.
- (5) Acid rain decrease the normal pH of soil and convert natural soil to acidic soil.

Effects of soil Pollution

- (1) Heavy metals, pesticides, acids etc from the industries and sewage discharge from the and effect soil fertility or productivity by causing change in physical, chemical and biological.
- (2) Radioactive waste replace the essential elements of body and cause many disease.
- (3) Nitrogen and phosphorous from the fertilizers in soil reach nearby water bodies and cause Eutrophication.

Eutrophication.

Eutrophication is the process in which a water body becomes overly enriched with nutrients, leading to the plentiful growth of plants and life. Eutrophication is considered to be a serious environmental concern since it often results in the deterioration of water quality and the depletion of dissolved oxygen in the water bodies.

Sewage sludge has many types of soil pathogenic bacteria, which transmitted many diseases from soil to human beings.

Soil the eggs of parasitic worms get incubated in the soil, these eggs larvae are highly infectious infections.

Control of Soil Pollution

- (1) Effluents should be properly treated before discharging of soil.
- (2) Effective treatment of domestic sewage by suitable biological and chemical methods, adopting modern techniques of sludge disposal.
- (3) From the waste material, recovering of useful products few should be done.
- (4) Biodegradable organic waste should be used for generation of biogas.
- (5) Cattle dung should be used for methane (CH_4) generation.

Unit - 02

Natural Resources

- Natural Resources → Life on this earth depends upon a variety of life support materials or resources provided by the nature. These resources are known as Natural Resources. e.g. → Water resources, mineral resources, solar energy, wind energy, fossil fuel etc.

Classification of Natural Resources

↓ Perpetual Natural Resources	↓ Renewable Natural Resources	↓ Non-renewable Natural Resources
<ul style="list-style-type: none"> → Solar energy → Wind energy → Tidal energy 	<ul style="list-style-type: none"> → Water resources → Soil " → Forest " → Food " → Energy " 	<ul style="list-style-type: none"> → Fossil fuel → Nuclear energy → Mineral energy → Biological energy

Types of Natural Resources

There are three types of Natural Resources.

- (1) Perpetual Natural Resources → Perpetual Natural Resources are those natural resources that naturally perpetuate themselves and are not affected by human use. For ex → Solar energy, Tidal ^{Power} energy, Rainfall, Geothermal Energy etc.



(2) Renewable Natural Resources → these can be recycled and regenerated within a given span of time.

For example → Water resources, Air resources, forest resources, food resources etc.

Non-Renewable Natural Resources → Non-renewable Resources are those natural resources that can not be regenerated or recycled within a given span of time.

For example → Nuclear fuel energy, Fossil fuels, Biological energy, Minerals resources etc.

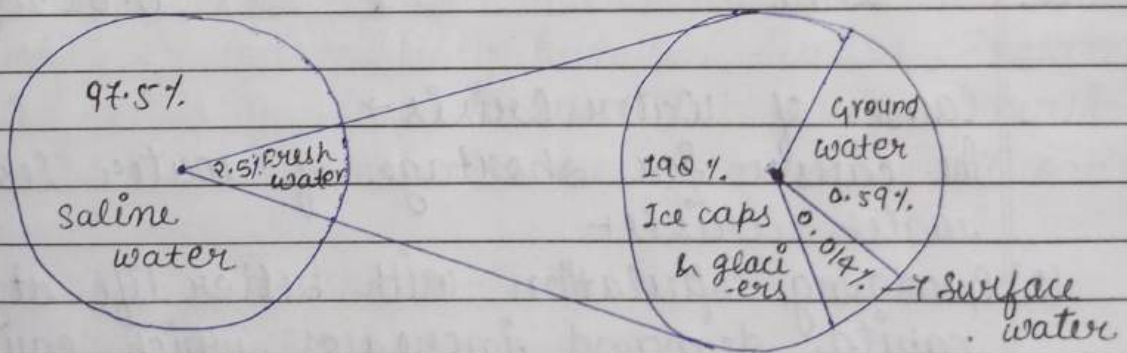
Water Resources

Water Resources are sources of water that are useful for human beings (living organisms). About 97% of earth surface is covered with water.

Water is the essential for the assistance of life, Plants, animals and the human beings cannot survived without water. Use of water are in agricultural, domestic, industrial and environmental) activities. Water is essential for economic growth, Biodiversity conservation, food security and health care.

* Availability of water:-

1. Water is an essential natural resource on which life depends.
2. Approximately 97% of the earth is covered by water.
3. The total water (salt water) and rest are 2.5% fresh water.
4. Even this small fraction of fresh water is not available to us, as most of it is in the form of Ice caps (1.98%) and just (0.5%) is available to us.
5. Water is needed for irrigation, industrial use, electricity production, and domestic use.
6. INDIA uses 90% of its water for agriculture, 7% for industries and remaining 3% for domestic use.



Water Quality

The water, even a healthiest river, lake is not pure, all water contains many naturally occurring impurity (substances) mainly sulphate oxide, magnesium, calcium, dissolved chemicals etc.

It is estimated that 80% of



sickness in the world is due to improper quality of drinking water.

Drinking water standards

S. No.	Substances	Desirable limit
1.	pH	6.5 - 8.5
2.	Total Hardness	300 mg/L
3.	Chloride	250 mg/L
4.	Fluoride	1.5 mg/L
5.	Calcium	75 mg/L
6.	Magnesium	30 mg/L
7.	Nitrate	45 mg/L
8.	Arsenic	0.01 mg/L
9.	E. coli	0.01 mg/L Nil.
10.	Lead	0.01 mg/L

Causes of water crisis →

The causes for shortage of water leading to water crisis →

- (1) Growing Population with better life style per capita demand increases which causes shortage of water.

Per capita water consumption

$$= \frac{\text{Island wide water}}{\text{Population}}$$

- (2) Local and country water distribution is also responsible for water crisis.



- (3) Fresh water resources are reduced by pollution. Industrial waste, chemical waste and agricultural waste are disposed in water which pollute water and cause water pollution.
- (4) Increase in extreme weather condition, like floods and drought.
- (5) Climate change will also increase in global water scarcity.
- (6) Growing population of developing countries are exposed to polluted water sources and finally causes water pollution.

Water Borne Disease +

waste material that are discharged into water bodies contains pathogenic microorganisms that are capable of transmitting human disease, contaminated drinking water, used in the preparation of food can be the source of number of water borne diseases.



S. No.	Water borne disease	causing agent	Symptoms
1.	Typhoid	Salmonella typhi (Bacteria)	characterized by headache, sickness, loss of desire for food.
2.	Cholera	Vibrio cholerae (Bacteria)	Diarrhoea, vomiting, dehydration, kidney failure, even death.
3.	Diarrhoea	Rotavirus Norovirus	characterized by dehydration (loss of body fluids)
4.	Amoebiasis	Entamoeba histolytica (protozoa)	Abdominal pain, loose motions, weight loss.
5.	Dysentery	Shigella dysenteriae (Bacteria)	Abdominal pain, diarrhoea, muscular pain & blood in stools.

Fluoride Problem in Drinking Water.

Fluoride is one of the very few chemicals that has been shown to cause significance in people through drinking water. Fluoride has beneficial effect on teeth at low concentration in drinking water but excessive exposure of fluoride in

drinking water can give rise to number of adverse effects.

Some amount of fluoride is require in drinking water to prevent teeth decay. Therefore fluoride is added to public drinking water supply because naturally fluoride is low.

Permissible limit +

Maximum tolerance limit in human body is 1.5 mg/L

Effects of Fluorides +

Fluoride exposure may lead to dental fluorosis and skeletal fluorosis.

Dental Fluorosis +

- (1) High level of fluoride associated with dental fluorosis and may be vary from yellow teeth, loss of enamel and dental cavities.
- (2) Low level of fluoride less than 0.1 mg/L associated with high level of dental decay.

Skeletal Fluorosis

The Deformation of bones causing knock knee syndrome, bow legs, joints pain and back pain.

Ways to Remove Fluoride from water +

- (1) Reverse Osmosis process
- (2) Distillation filtration.



(3) Nalgonda process

(1) Reverse Osmosis process → It is used to purify several types of bottled water. Reverse osmosis systems are generally unaffordable for personal use.

(2) Distillation filtration → These are commercially available distillation filters that can be purchased to remove fluoride from water.

(3) Nalgonda process → It can be done with the help of bone charcoal. Nalgonda process developed & adopted by National Environmental Engineering Research Institute (NEERI), Nagpur Maharashtra in 1974.

Nalgonda Techniques involves addition of aluminium salts, lime and bleaching powder followed by rapid mixing can be used to remove fluoride from water.

Arsenic Problem in drinking water →

Arsenic may be found in water which has flowed through arsenic rich rocks. Several health defects have been ~~absor~~ observed in population drinking water. observed in population over long period of time.

According to WHO, maximum permissible limit of arsenic is 0.01 mg/l in drinking water.



Sources of Arsenic

- (i) Arsenic is widely distributed throughout the earth's crust.
- (ii) Arsenic is not mined directly but during purification process of several ores of other metals containing arsenic which release in the atmosphere or environment.
- (iii) Industrial effluents also contribute arsenic into water.
- (iv) Several anthropogenic sources of arsenic in the environment includes arsenic containing pesticides, fertilizers, pharmaceuticals, drugs etc.

Effect of Arsenic

- (i) Immediate symptoms of Arsenic includes vomiting, abdominal pain, diarrhoea etc.
- (ii) Long term exposure to arsenic by drinking water causes skin cancer, lung cancer, urinary bladder cancer, kidney damage etc.
- (iii) The first changes are usually observed in the skin change, pigmentation changes and thickening of skin.
- (iv) Exposure to Arsenic by drinking water has been caused several disease of blood vessels leading to gangrene in China.
- (v) Black foot disease is a form of vascular disease has been reported due to arsenic toxicity in Taiwan.



Control measures of arsenic

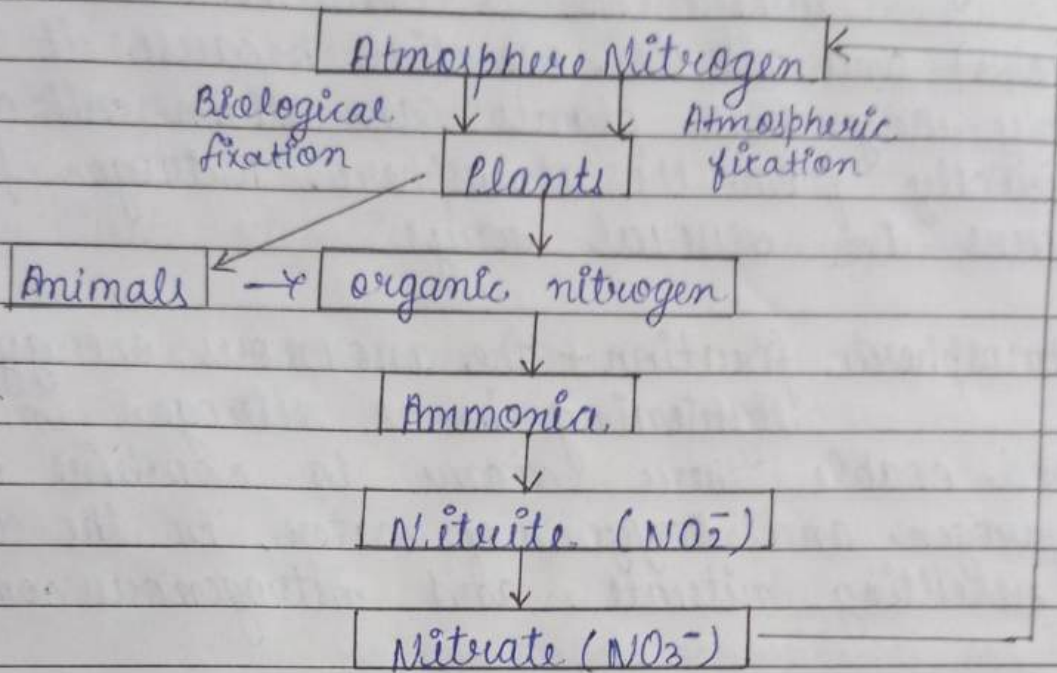
- (1) Reverse Osmosis + this is used to purify arsenic contaminated water through membrane filter.
- (2) Oil Ion exchange + Water passes through ~~an~~ resin bed which removes arsenic from arsenic contaminated water.
- (3) Distillation Filtration + Reverse driven membrane technologies to remove arsenic from arsenic contaminated water.
- (4) Activated Carbon + It is made-up of high quality coal that are widely used in water purification process or remove arsenic from arsenic contaminated water.

Material cycle or Nutrient Cycle or Biogeochemical cycle.

Nutrients like nitrogen, carbon, sulphur, etc move in circular path through biotic to abiotic component and abiotic to biotic component are therefore, known as biogeochemical cycle or nutrient cycle or material cycle.



Nitrogen Cycle ✖



Nitrogen is one of the primary nutrients which is essential for the survival of a living organisms. Nitrogen is an essential component of nucleic acid and proteins the building blocks of life.

Nitrogen cycle

through the ecosystem involves the following four processes.

- (i) Nitrogen fixation
- (ii) Atmospheric fixation
- (iii) Biological fixation

- (2) Nitrogen mineralization
- (3) Nitrification
- (4) Denitrification

(1) Nitrogen Fixation → Nitrogen fixation is a process where N_2 is converted into ammonia (NH_3) and nitrate, essential because it is the only way that plants can attain nitrogen directly from the atmosphere. Nitrogen fixation occurs in several ways

(i) Atmospheric fixation → The enormous energy of lightening break nitrogen molecules and enable these atoms to combine with hydrogen and oxygen of water. In the air, resulting nitrate and nitrogenous compound.

(ii) Biological fixation → Approximately 65% of air Nitrogen fixed by this process. Certain bacteria like rhizobium and Azotobacter that fixed nitrogen through metabolic process. The product of such fixation is Ammonia (NH_3) which is quickly incorporated into proteins and other organic nitrogen compounds either by host plants or bacteria itself or bacteria itself.

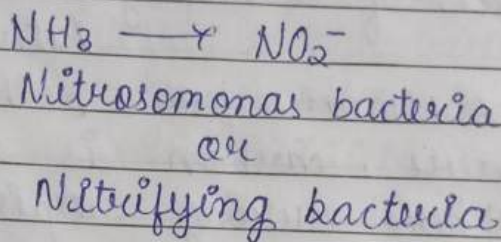
(2) Nitrogen Mineralization → After nitrogen is incorporated into organic matter, it is often converting back into inorganic nitrogen by a process called nitrogen mineralization otherwise known as decay, when plants and organisms die, decomposition of organic matter into inorganic nitrogen



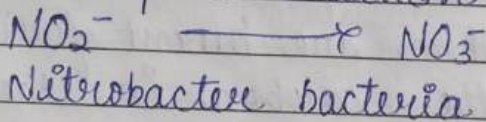
(3) Nitrification

Nitrification is the process that converts Ammonia (NH_3) into nitrite (NO_2^-) and further to nitrate by a process called nitrification.

(A) The first step is the oxidation of ammonia to nitrite



(B) The second step is oxidation of nitrite to nitrate.



(4) Denitrification

Denitrification is an anaerobic process that is carried out by denitrifying bacteria (Pseudomonas). Thus nitrate is converted to nitrogen and returning it to the atmosphere.

Carbon Cycle

Draw in back

Carbon cycle

Carbon is the basic building element of all living organisms. By volume carbon dioxide (CO_2) in the atmosphere is very low 0.03%. It is absorbed by the plants in the form of CO_2 from the atmosphere by the process called photosynthesis in the presence of chlorophyll and sunlight.

Later on CO_2 is utilized by consumers from both the producers and consumers, carbon is returned back to the atmosphere during respiration. And when they die the carbon is returned to the soil during decomposition process.

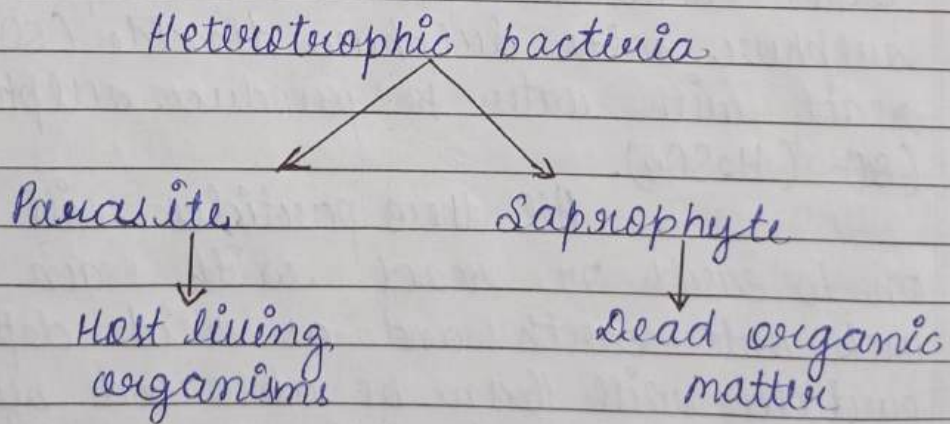
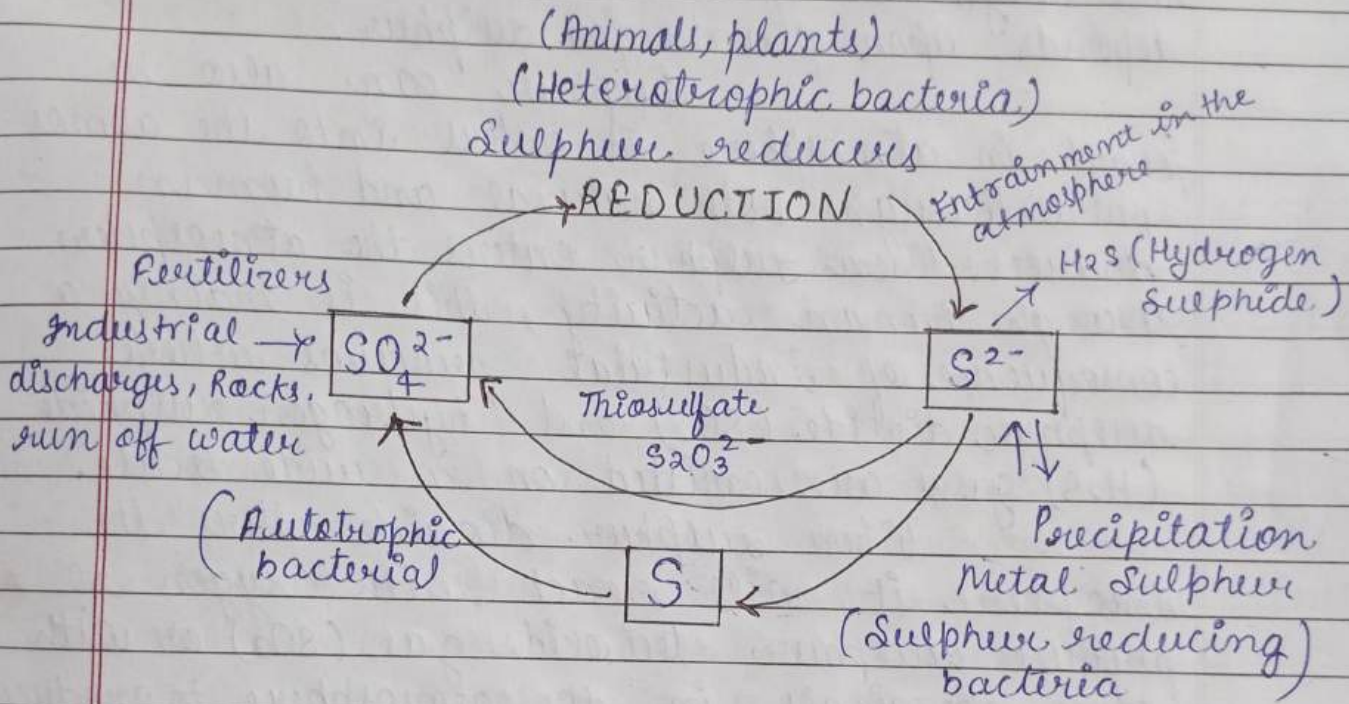
When we burnt fossil fuels like oil, coal etc. the carbon in the fuel combined with atmospheric oxygen to form CO_2 and finally returned it into the atmosphere.

Sea water is the second major reservoir of carbon. Once carbon dissolved in sea water, carbon dioxide can remain as it is or can be converted into carbonate (CO_3^{2-}) or bicarbonate (HCO_3^-). Some marine organisms biologically fix bicarbonate with calcium to produce (CaCO_3). This substance is used to produce their shells and other body parts.

When these organisms die, their shells and other body parts sink to the ocean. After long period of time these deposits are physically and chemically change in sedimentary rocks and then convert organic.

carbon bi-geochemical process to fossil fuel.

Sulphur Cycle



Sulphur is considered a secondary element, along with calcium and magnesium. Sulphur is required in moderate amounts by plants, but is less likely to limit crop growth.



than nitrogen, phosphorous or potassium. Sulphur is one of the components that make-up proteins and vitamins. Proteins consist of amino acids that contains sulphur atom. Sulphur is important for the functioning of proteins and enzymes in plants, and in animals that depends upon plants for sulphur.

Sulphur can also be found in atmosphere. It enters into the atmosphere through both natural and human sources. When sulphur enters the atmosphere through human activity, this is mainly a consequence of industrial processes where sulphur dioxide (SO_2) and hydrogen sulphide (H_2S) gases are emitted on a wide scale.

When sulphur dioxide enters the atmosphere it will react with oxygen to produce sulphur trioxide gas (SO_3) or with other chemicals in the atmosphere, to produce sulphur salts. Sulphur dioxide (SO_2) may also react with water to produce sulphuric acid (H_2SO_4).

All these particles will settle back on to earth or react with rain and fall back onto earth and as acid deposition. The particles will than be absorbed by plants again are released back into the atmosphere, so that the sulphur cycle will start over again.



conventional and non-conventional sources of Energy

There are two major sources of energy can be classified below:-

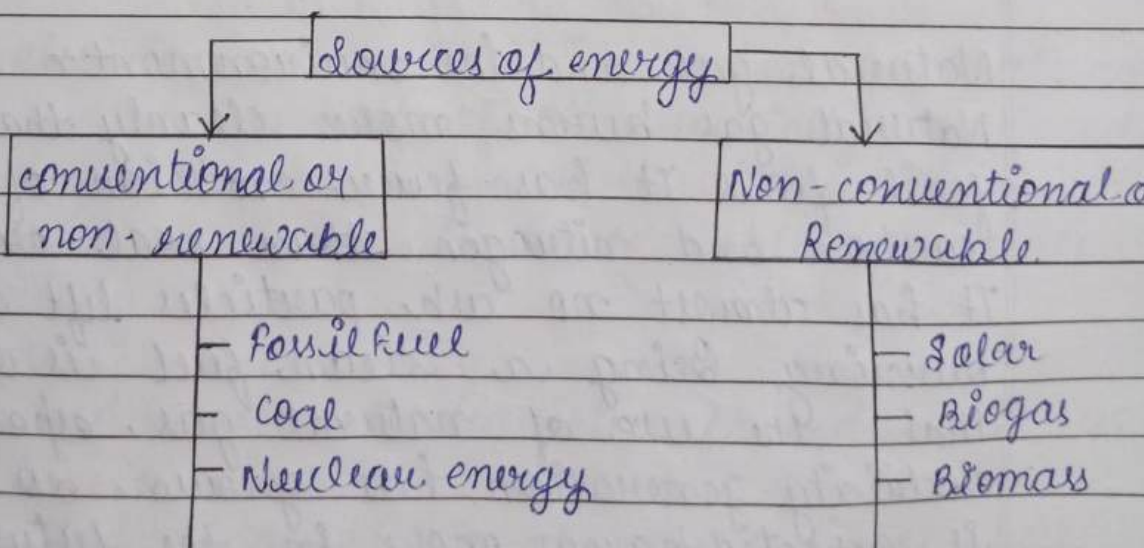
- (i) Conventional source of energy
- (ii) Non-conventional source of energy

(i) Conventional source of energy

These sources of energy are also known as non-renewable sources of energy. And are limited. For example:- Natural gas, coal, nuclear energy etc.

(ii) Non-conventional source of energy

These sources of energy are also known as renewable sources of energy and are unlimited. For ex:- Solar energy, biogas, biomass, hydropower, etc.





(1) Fossil fuel → It is a hydrocarbon containing materials such as coal and natural gas formed naturally from earth's crust. From the remains of dead plants and animals. Fossil fuel may be burned to provide heat for cooking process, power engines and to generate electricity.

Use of natural gas →

Natural gas is also an essential raw material for many common products such as paints, fertilizers, plastics, photographic film, medicines and explosives.

Industry depends on it. Natural gas has thousands of uses. It is used to produce steel, glass, paper, electricity and much more. Homes use natural gas to fuel stoves, furnaces, water heaters and other household appliances.

Natural gas and the environment →

Natural gas burns more cleanly than other fossil fuels. It has fewer emissions of sulphur, carbon and nitrogen than coal or oil. It has almost no ash particles left after burning. Being a clean fuel is one reason that the use of natural gas, especially for electricity generation, has grown so much and is expected to grow more in the future. Of course, there are environmental concerns with the use of any fuel.



As with other fossil fuels, burning natural gas produces carbon dioxide (CO_2), which is the most important green house gas.

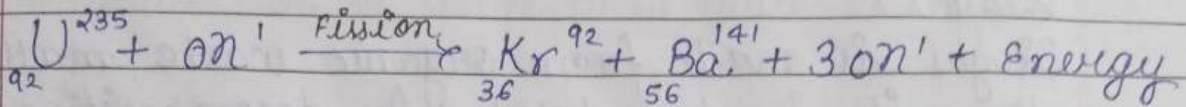
Coal

Coal is a combustible black or brownish black sedimentary rock composed mostly of carbon and hydrocarbons. Coal is a non-renewable energy source because it takes millions of years to create. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the earth was partly covered with swampy forests.

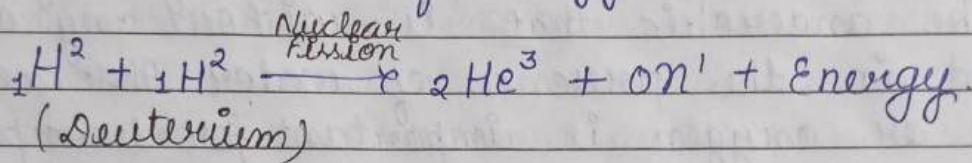
Uses of Coal

The coal is used for generating electricity and basic energy source. In many industries, including steel, cement and paper. The major uses of coal are:-

- (1) For electric power → Coal is used to generate about half of all electricity produced. Power plants burn coal to make steam. The steam runs turbines which generate electricity.
- (2) For industry → A variety of industries use coal's heat and by products. Separated ingredients of coal such as methanol and ethylene are used in making plastics, synthetic fibres, fertilizers and medicines.



(2) Nuclear Fusion - When two lighter nuclei are heated to a very high temperature, they fuse together to form a stable nucleus and enormous amount of energy.



Solar Energy

Solar energy is the energy received by earth from the sun that is converted to thermal or electrical energy as a renewable energy sources, it is important part of our clean energy for future.

Solar Energy Devices

Solar Energy is a term for describing a range methods for obtaining energy from the sun.

There are following solar energy devices which has been shown below:-

- 1) Solar cooker
- 2) Solar cell or photovoltaic cell (pv) cells
- 3) ^{solar} Water heaters
- 4) Solar Pumps

Biogas

Biogas is made from organic waste matter after it is decomposed. The decomposition breaks down the organic matter releasing various types of gases. The main gases released are methane, carbon dioxide, hydrogen and hydrogen sulphide. Bacteria carry out the decomposition. The conditions for creating biogas have to be anaerobic that is without any air and in the presence of water. Absence of air or oxygen is important for decomposition because bacteria then take oxygen from the waste material itself and in the process break them down.

Uses of Biogas

- (1) Biogas is used as cooking fuel. This is because biogas burns without smoke, has high calorific value, can be piped into kitchens directly from a plant and is cheaper in cost.
- (2) High calorific value of a fuel generate more amount of heat energy.
- (3) Biogas can be used to run electric engines such as pumps, as ~~beac~~ they cause less air pollution.
- (4) Biogas can be used for street lighting as they do not cause any smoke and the illumination



obtained can be made to be quite adequate.

Biomass

Biomass is defined as all plant material or vegetation, either raw or processed, wild or cultivated. Waste matter that is organic in nature is called biomass. Cattle dung, wood, household vegetable wastes, all are termed as biomass. Examples of this energy source include -

- (1) Fast growing trees and grasses.
- (2) Agricultural residue like used vegetable oil, wheat straw or corn.
- (3) Wood waste like paper & trash, saw dust, wood chips.
- (4) Methane that is captured from landfills, municipal waste water treatment.

Conversion of Biomass for Energy

Currently numerous technologies exist that convert organic material to commercial energy. Out of them few are mentioned below.

- (1) Alcohol fermentation - With alcohol fermentation, starches are converted to sugar and then to fuel alcohol. This alcohol is then distilled and separated. With yeast, materials such as wheat, barley, potatoes can be converted to alcohol.

(2) Landfill Gas & Decomposing organic waste generates gas as it is anaerobically digested. Approximately 50% of this methane, a major factor form natural gas.

(3) Gasification & the newest method for electricity generation, is known as gasification. This method captured 65% to 70% of the energy present in the solid fuels by first converting into combustible gases. These gases are then burned, like we currently burn natural gas, and create energy.

Some remaining topic of Unit - 03

Forest Resources

About 420 millions years ago, during the silurian period, ancient plants and Arthropodes began to occupy the land. Over the millions of years, land colonizers developed and adopted to their new habitats. The first forests were dominated by horsetails, club mosses and ferns that stood upto 40 ft. tall.

The land-scale changed again during the Pleocene Period, the surface of the planet that had been dominated by tropical forests and temperate forests spread in the northern hemisphere.

Availability of Forest Resources

Forests are one of the most important natural resources on this earth. Covering the earth like a green blanket these forests not only produce many goods material, but also provide several environmental services which are essential for life. It is estimated that forests covered ~~at~~ $\frac{1}{4}$ th of the earth's entire land area in 1940 and $\frac{1}{5}$ th in the 1980. There are approximately 1.2 billion hectares of open woodlands and savannah and nearly 2.5 billion hectares of closed forest. There are three major types of forest classified according to latitudes -

- (1) Tropical Forests - Tropical forests are characterized by the greatest diversity of species. They occur near the equator, within the area bounded by latitudes 23.5° N & 23.5° S. One of the major characteristics of tropical forest is their distinct seasonality: winter is absent. Only two seasons are present that is rainy and dry seasons. The length of day light is 12 hours and varies little. The temperature of tropical rain forest is on average 22° to 25° and varies little throughout the year. The flora and fauna includes orchid, ferns, mosses, and palms where as bats, numerous birds and insects.

(2) Temperate forest

Temperate forest occur in the eastern North America, Asia and Western and central Europe. The temperature of temperate forest varies from -30°C to 30°C . Flora and fauna includes below willow, cotton wood, Oak, hemlock where as squirrels, rabbits, birds, deer, wolf.

(3) Boreal forests:- Boreal forest occur between 50 and 60° North latitudes. Boreal forests can be found in the broad belt of Eurasia & North America. Temperature of boreal forests are very low. The flora and fauna present in the boreal forest includes conifers with needle like leaves, pines, fir & spruce and fox, wolf, deer and bats.

(4) Depletion of forest:-

(i) Over exploitation:- Humans have depended heavily on forest for food, medicine, shelter, wood and fuel. With growing population, the demands for raw materials like timber, pulp, minerals, fuelwood etc. Our forests contribute substantially to the national economy. The international timber trade alone is worth over US \$ 40 billions/year. Excessive use of fuel wood and charcoal, expansion of urban area, agricultural and industrial areas and overgrazing have together lead to over exploitation of our forests leading to their rapid degradation.

(ii)

Deforestation → Deforestation is the permanent destruction of original forests and woodlands. Deforestation is defined as the complete clearing of tree formation and their replacement by using land for other purpose. The term does not include the removal of industrial forest such as plantations of gums or pines. Deforestation has resulted in the reduction of original forests to 41.5th of their pre-agricultural area. Original forest now cover 24% of the earth's land surface. The main factors that cause deforestation are natural factors (fire, soil erosion and drought) Traditional factors (shifting cultivation, grazing and fuel), Economical factors (Agricultural and establishment of heavy industries).

Major causes of deforestation :-

There are following causes of deforestation which has been shown below →

1. Population growth
2. Shifting cultivation
3. Raw materials for industrial use
4. Development Projects
5. Overgrazing
6. Fires
7. Acid Rain

Consequences of Deforestation

Effects of deforestation are numerous Rise in temperature, low Rainfall, Excelerated soil erosion, loss of habitats and species. There are following consequences

which has been shown below:-

- (i) Biodiversity is lost and along with the genetic diversity is eroded.
- (ii) Problems of soil erosion and loss of soil fertility, increase. With the loss of a protective cover of vegetation more soil is lost.
- (iii) Decreases of recharge to ground water.
- (iv) Desertification & the causes of desertification are complex, but deforestation is one of the contributing factors.
- (v) Forests act as a major carbon store, because carbon dioxide (CO_2) is taken up from the atmosphere and used to produce the carbohydrates, fats and proteins that make up the tree. When forest are clear, and the tree are either burnt, this carbon is realized as CO_2 . This lead to an increase in the atmospheric concentration of CO_2 , CO_2 is the major contributor of the green house effect. It is estimated that deforestation contribute 1-3rd of all releases caused by people.

Chipko Movement & the chipko movement of the UK region in the North waste part of India, begin as a communal region of a local villagers to protect their forest from commercial deforestation practices. The term, "chipko Movement" which literally means to 'embrace' was designated to these villagers who reacted by actually hugging the trees.

Unit - 4Current Environmental Issues of Importance

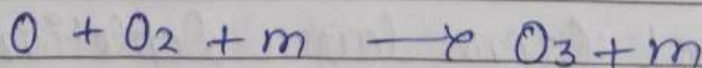
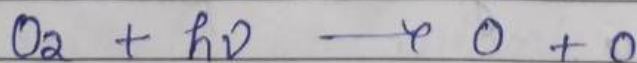
Ozone layer → From the last millions of year the earth has natural "sun screen" in the stratosphere called to O_3 . This layer filtered out harmful ultraviolet rays from the sun light. The protecting ozone layer is useful for sustaining life of human beings animals and plant.

What is Ozone?

Ozone is a form of oxygen. Ozone can be defined as a tri-atomic form of oxygen.

Formation of Ozone →

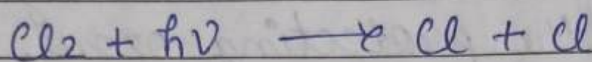
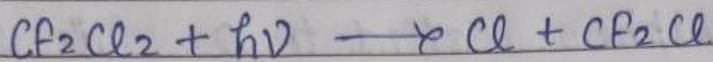
The atmospheric oxygen absorbed UV radiation lesser or shorter than to 240nm Ozone is formed in the upper stratosphere by the following photochemical reaction.



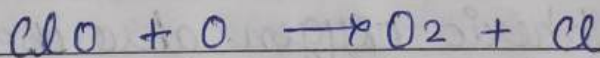
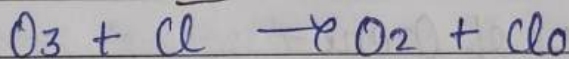
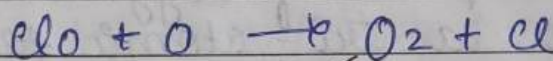
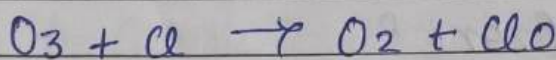
m → third body like N_2, O_2 etc.

(CFCs) are lighter than air so they rise into the stratosphere where ultra-violet free the Cl atom.

Keying $CFCl_2$ reaction. (CFC-12 reaction)



Depletion of Ozone catalytic cycles -



And soon

Cl atom generated can destroy ^{thousands} through of ozone as long chain process before it get defuse.

Affect of Ozone layer Depletion

- The various forms of skin cancer by excessive exposure to UV rays +

- Exposure to UV rays, causes soiling of skin ageing etc.
- In human beings they increase incidence of U.V. radiation, increases the cataracts and genetic defects.
- Death of phy to planktons in marine environment. So that entire ecosystem could be collapsed.
- The marine organisms like fishes will reduce in the axis of supply of food.
- In plants, U.V rays causes visible symptoms to laws there by reducing their photo synthetic efficiency.
- Yield of vital crop plants like wheat, rice, soybean, cotton, & sorghum will decrease.

Remedial measures of control.

- Avoid any fire extinguisher contain bromine based halons, prefer water or dry chemicals.
- Spread awareness about the restricted use of CFCs for the healthy survival of human beings, animals and plants.
- Avoid purchasing & using refrigerators, A.C etc which use chloro fluoro carbon (CFC's) from etc. used as coolants.
- Hydro chloro fluoro carbons such as (CF_3CHCl_2) and hydro fluoro carbons like (CF_3CHF_2) are the substituents.

-ute for CFC's. They can be used as refrigerants
-nt are none ozone depleting.

- Facilitate advance research to pluck the ozone hole that have already been formed.
- A limited use refrigerator, A.C's which use CFC's as a coolant.

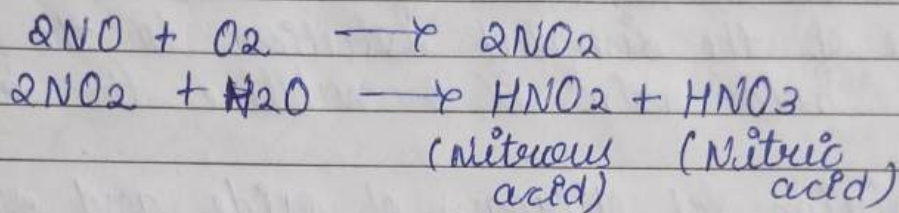
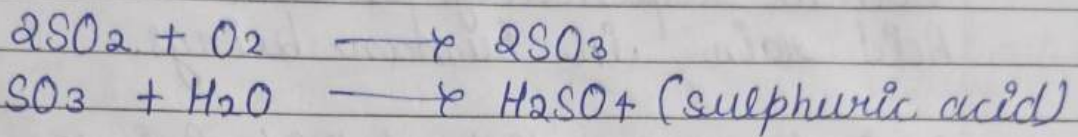
Acid Rain → Acid rain refers to are precipitation which is more acidic than the normal.

Acid rain is rain which is usually acidic. (PH is less than the normal range of 5 to 6), cause mainly by atmospheric pollution with sulphur dioxide (SO_2) and nitrogen compounds.

Causes of Acid Rain →

- Acid rain is caused by smoke & gases like oxides of sulphur & nitrogen (SO_x & NO_x) originating from industries and fossil fuel combustion are the major sources.
- When these fuels are burned to produce energy the sulphur that is present in the fuel combines with oxygen and become sulphur dioxide (SO_2).
- Some of the nitrogen in the air becomes nitrogen oxide.

- These pollutants go into to the atmosphere, react with rain water and converted into sulphuric acid (H_2SO_4) and nitric acid (HNO_3).
- These acids causes acid rain. The main reactions are as follows -



Effects of Acid Rain, &

- Acid rain cause a number of harmful effects below pH 5 to 6.
- It causes corrosion of building specially made by marbles.
- It damage stone statues, priceless stone statues in gresh (unon) and Itli have been partially dissolved by acid rain.
- Aquatic life specially fish are badly effected by lake acidification.
- Main lakes of swedem name, canada has become fishless due to acid rain.



- Acid rain can effect vegetation and soil fertility and many ways.
- Human can become seriously ill and can even die from the effect of acid rain.
- Various respiratory problem can cause by Acid rain in human beings.

Control. OR Remedial of Acid Rain *

One of the simplest solution to the problem of acid rain is to utilize the acid lime.

- Emission of Nitrogen oxide and sulphur from the industry should be reduce by using pollution control equipment.

Green House effect or Global Warming *

Increasing in temperature (Global Warming) due to increase in concentration of green house gases mainly carbon dioxide.

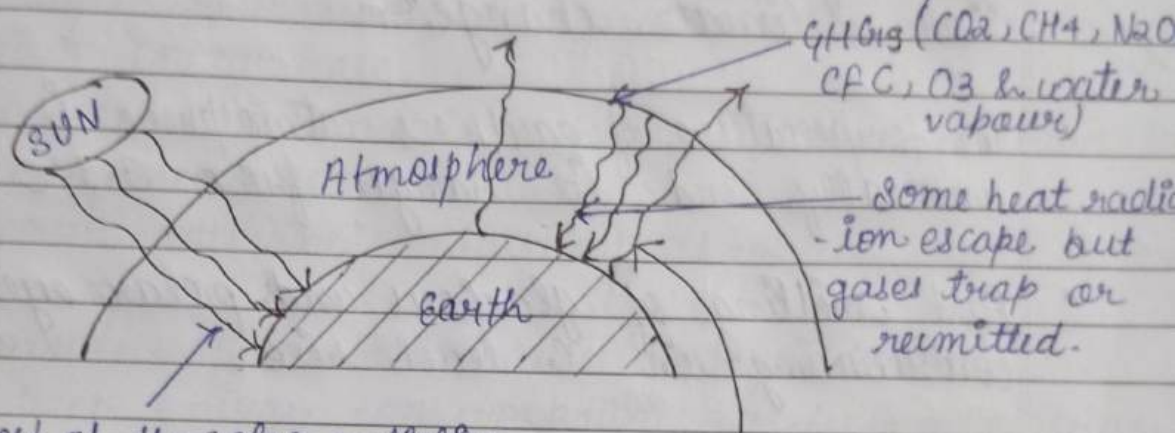
Green house effect is progressive warming up of the earth surface due to blanketing effect of man-made activities or green house gases in the atmosphere.

Phenomenon of Green House effect *

Global warming is cause due to trapping of outgoing thermal infrared energy / radiation or long wave solar radiation by atmospheric green house gas house gases their by increas

Inq, the surface temperature. This phenomenon is known as green house effect.

Green house effect is shown by a number of gases known as green house gases such as CO_2 , CH_4 , CFC's, N_2O , Ozone & water vapour. Increased concentration in the atmosphere.



Most of the solar radiation absorbed by the earth surface

Infrared heat radiation emitted by earth surface

Green House gases and their Contribution

S. No.	GHGs	Contribution in %	Source (production)
1)	Carbon dioxide (CO_2)	56 %	Burning of fossil fuel, automobile, deforestation, & respiration
2)	Methane (CH_4)	18 %	Anaerobic decomposition of organic waste, swamps, & rice field
3)	CFC	13 %	coolants & cleaning solvent
4)	N_2O (Nitrous oxide)	7 %	Nitrogen fuel, fertilizers & industrial

5)	Ozone (O_3)	Minor contribution	Semiconductor manufacturing
6)	Water vapour	Minor contribution	Evaporation of surface water.

Effects of Global Warming Or green house effect or climate change.

- The temperature of earth's atmosphere is increase annually and it ranges from $0.1^{\circ}C$ to $0.2^{\circ}C$.
- Fast melting of glaciers and polar ice in contributing in sea level rise.
- Due to sea level rise a number of coastal cities like New York, Mumbai, London, Goa etc. are facing of sinking in sea.
- The rise in global temperature would produce new pattern of drought and rainfall.
- Rainfall pattern will be highly disturbed across the world. This will result into ecological disturbance, forest fire, loss of biodiversity etc.
- The dislocation and possible migration of certain biological species.
- Global warming will also result into loss of agricultural productivity.

- Higher temperature, humidity will increase various respiratory & skin diseases.

Remedial measures of global warming

- Reduce transport sector emission by less and smart driving.
- Promote renewable energy uses like solar energy, wind energy etc.
- Promote sustainable agriculture, cultural, sustainable development etc.
- Recover methane combustion through waste management.
- Promote afforestation and reforestation.
- Reduce energy consumption by using energy efficient home appliances.
- Reduce waste, prefer re-useable product or recyclable product.

Ozone Hole +

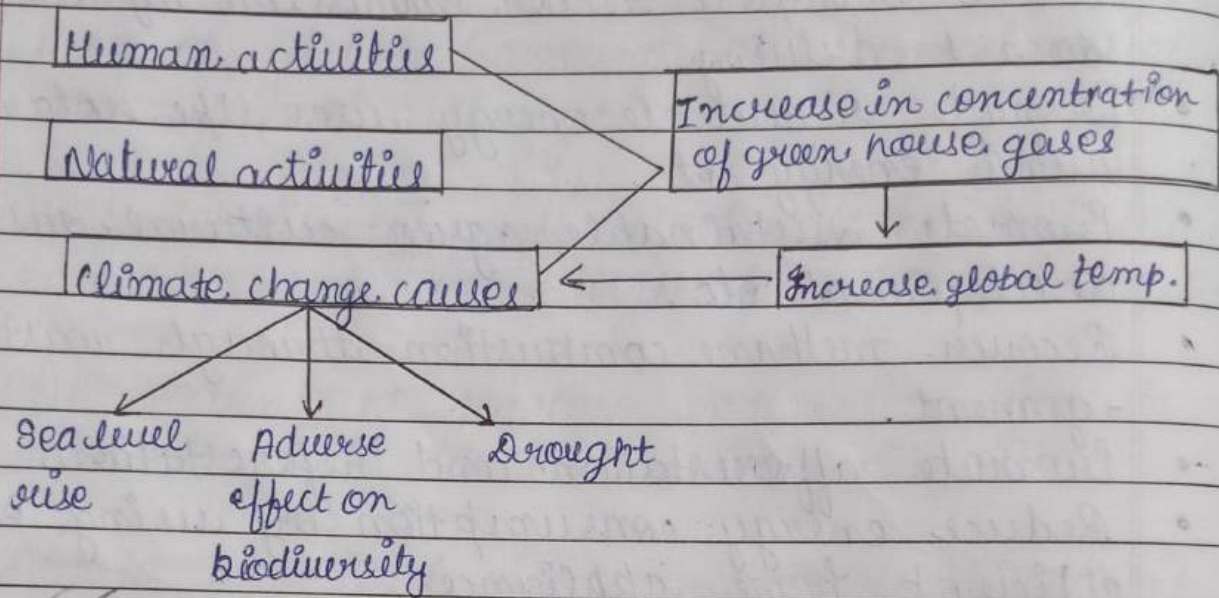
- Dramatic loss of ozone in the lower stratosphere over Antarctica.
- The ozone hole is more correctly described as a low concentration of ozone.

Ozone layer depletion +

- Ozone layer depletion or thinning of ozone.
- (1) Ozone hole formation occurs by the destruction of ozone due to its reaction with chlorine atom in the stratosphere.
- (2) Chloro fluoro carbons (CFC's) are mainly responsible for ozone layer depletion in the stratosphere.

-phere.

- (3) CFC-11 (CFCl_3) and CFC-12 (CF_2Cl_2) are the CFC's most commonly used as coolant in refrigerator, air conditioners and cleaning solvents.



Auto Mobile Pollution

Use of motor vehicles has increase rapidly with in last century accross the world due to the increase in auto mobiles most of the major cities have been experiencing serious vehicular pollution problem.

People specially in urban areas are exposed to auto mobile exhaust. Various mixture of gases that comes from auto mobile pollute the our atmosphere and are fast making the environment a place unfit for living being.

Automobiles emits large quantities of carbon monoxide (CO), Hydro Carbon, Sulphur dioxide (SO_2), lead (Pb), Oxides of Nitrogen &



Sulphur (NO_x and SO_x) and suspended particulate matter.

Pollution Hazards and human health.

Pollutants	Effects on Human Health	Effects on the natural environment
1- Carbon monoxide [CO]	Can affect the cardiovascular systems. It can also affect the CNS impairing vision & headaches.	
2- Nitrogen oxides (NO_x)	Nitrogen dioxide can affect the respiratory systems	NO & NO_2 can contribute to acid deposition on damaging aquatic ecosystem. NO_x can also have a fertilizing effects on forests.
3- Sulphur dioxide (SO_2)	It can affect lung function.	It contributes acid deposition. important to aquatic & forest ecosystems.
4- Suspended particulate matter	It can alter the immune system & respiration system	Fine particulate matter can reduce visibility.
5- Lead	Lead can be cause brain damage.	



Effects of auto mobile system →

- Oxides of nitrogen can affect the respiratory system, irritation in the eyes, nose etc.
- Sulphur dioxide (SO_2) can affect lung function
- Suspended particulate matter (SPM) can affect respiratory system and also affect the lung tissues.
- Lead can cause brain damage in children resulting in low I.Q (Intelligent quotient), even death.

Control Measures of Automobile Pollution →

- Use of alternative fuel which generate less pollutants.
- Use of catalytic converter.
- Change oil (lubricant) during recommended time period.
- Regular check-up of spark, spark plug clean and replace if it is necessary.
- Maintenance and servicing of vehicles at regular time interval.
- Use of mass transport system like bus, train, metro etc.



Population Growth ->

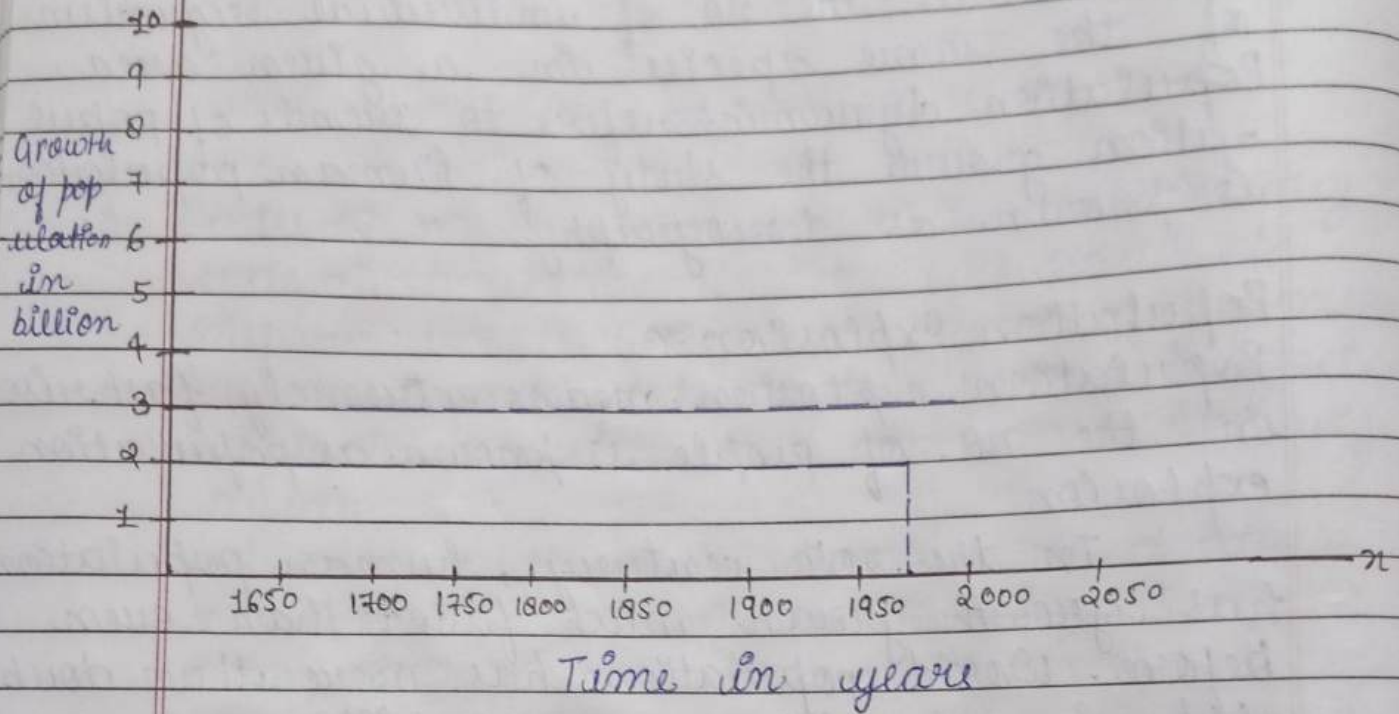
Population is the no. of individual organisms of the same species in a given area. Population dynamic refers to trends of population growth. The study of human population is known as demography.

Population Explosion ->

Population explosion means extremely fast rise in the no. of people is known as population explosion.

In the 20th century, human population has grown much faster than ever before. World population has more than doubled in only like years 2 billions in 1930 to 4 billions in 1974, & 6 billion in 1999. It reach 7 billions in 2011 and may reach 8 billion by 2022.

Human population may reach 10 billions in 2055. This unexpected growth of human population at an alarming rate is refers to population explosion. Population explosion shown in figure which is shown below.



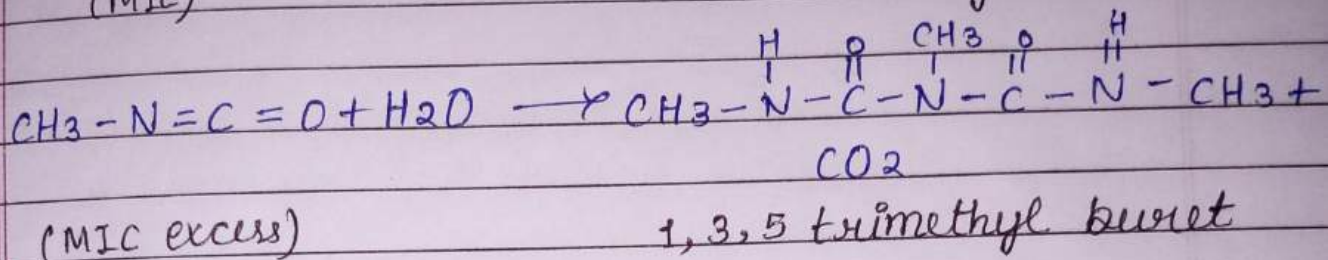
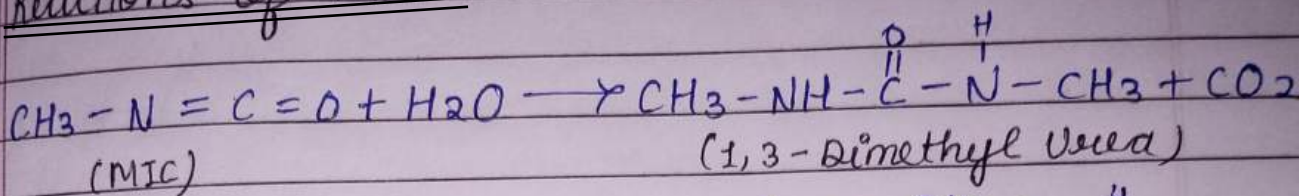
Population explosion scenario in India &

Years	Population in millions
1961	459
1971	567
1981	715
1991	891
2001	1075
2011	1251
2021	1407



BHOPAL GAS TRAGEDY

Reactions of MIC



Exothermic reaction which leads to an increase in pressure which caused the safety valve to burst & the gas leaked out.

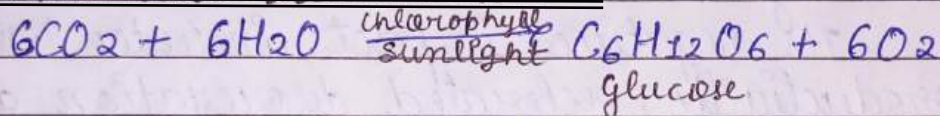


Photoautotrophs & Chemoautotrophs

These are mainly green plants, which can synthesize their food themselves by making use of carbon dioxide (CO_2) present in the air and water in the presence of sunlight by enclosing chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. They are also known as photoautotrophs.

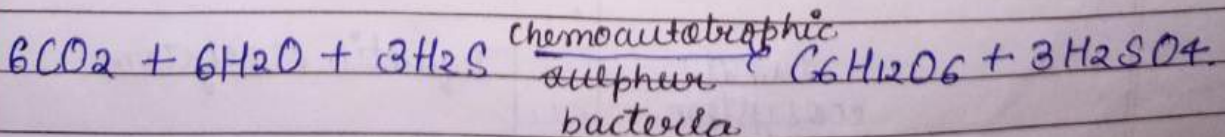
\downarrow \downarrow \downarrow
 light Self foods

Chemical reaction



Chemoautotrophs - There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. They are known as chemosynthetic organisms or chemoautotrophs. For instance in the oceans depths, where there is no sunlight, chemoautotrophic sulphur bacteria make use of the heat generated by the decay of the radioactive elements present in the earth's core and released in oceans depth. They use this heat to convert dissolved hydrogen sulphide (H_2S) and carbon dioxide (CO_2) into organic compounds.

Chemical reaction





In 2023, India overtook China as the country with the largest population in the world, with more than 1.42 billion people. China now has the second largest population in the world. India alone has about 18% of the world population. India has 1.42 billion people, one of the most crowded countries in the world. The average population density of India is 401 people/sq. km.

Causes of Population Explosion

- * Increase in birth rate.
- * Decrease in death rate.
- * Lack of awareness towards family planning.
- * Poverty and illiteracy.
- * Marriage at lower age.

Effect of Population Explosion

- * About 1/3rd of the total population is poor and it is subjected to live below the poverty line.
- * Forest has been declined.
- * Water and other natural resources are decreasing.
- * Ecosystem and biodiversity is in danger.
- * India is facing energy crisis.



Burning of Paddy straw

Paddy straw is produced as a by product of rice production at harvest. During harvest, rice straw is removed with the rice grains and spread out in the field depending on how it was harvested, either manually or by using machines. The paddy crop is harvested between the first and last weeks of October in Punjab and Haryana.

Every year around this time, the farmers set paddy stubble ablaze in the endogang Indo-Gangetic plains of farmers in Punjab, Haryana and Uttar Pradesh to prepare ground for Rabi crop sowing. After harvesting, the rice straw is openly burnt in the fields. Due to shortage of funds, shortage of time and as a easy method of disposal before sowing the next crop.

Another region is rainy weather after harvest can leave fields too wet. Burning straw is considered a low cost solution alternative to tilling in the straw. Under such circumstances, farmers may feel they have no choice but to burn the straw.

In addition to wheat and paddy, sugarcane leaves are most commonly burnt. According to an official report more than 500 million tonnes of parali (crop residues) is produce annually in the

Date _____ ☺

country, ^{cereal} ~~aristal~~ crops (rice, wheat, maize and millets) account for 70% of the total crop residue.

According to an estimate, 20 million tonnes of rice stubble is produced every year in punjab alone, 80% of which is burnt.

Environmental and Health risk.

In the process, they damage soil quality and cause heavy pollution. Traditionally much of the produced rice straw has especially smoke and green house gases. A study estimate that crop residue burning released 149.24 million tonnes of carbon dioxide (CO_2), Over 9 million tonnes of carbon monoxide (CO), 0.25 million tonnes of Oxides of Sulphur (SO_x), 1.20 million tonnes of particulate matter and 0.07 million tonnes of black carbon.

(Titendra et al., 2017) According to a report one ~~ten~~ ton stubble burning ~~to~~ leads to a loss of 5.5 kg nitrogen, 2.3 kg phosphorus, 25 kg potassium and more than 1 kg of sulphur (all soil nutrients besides organic carbon).

The heat from burning paddy straw penetrates 1 cm into the soil, elevating the temperature to $33.8^\circ C$ to $42.2^\circ C$. This kills the bacterial and fungal populations critical for a fertile soil. Burning of crop residue



causes damage to other microorganisms present in the upper layer of the soil as well as its organic quality. Due to the loss of friendly pests, the wrath of enemy pests has increased and as a result crops are more prone to disease.

Solutions to the Problem

Although straw is traditionally used as bedding for livestock, but as with other organic waste, since straw can be used for feeding the cattle, energy generation including ethanol, biogas and biooil. Instead of burning of the stubble, it can be used in different ways like composted manure, roofing in rural areas, biomass energy, biofuels (bio ethanol) and compressed biogas. Paddy straw made into pellets can be mixed along with coal in thermal power plants. This will save coal as well as reduce carbon emissions.

Measures taken by the Government

Burning crop residue is a crime under section 188 of the IPC and under the Air and Pollution Control Act of 1981. On December 10, 2018 National Green Tribunal (NGT) had banned crop residue burning in the states of Rajasthan, Uttar Pradesh, Haryana and Punjab. The Delhi high court has also ordered against burning residues while Punjab government



imposed a penalty of Rupees 73.2 lakhs. Farmers in 2016 for burning of crop residue.

Although the actual amount of the fines charged was not available; Farmers continue to burn residues every season this making both the soil and air poisonous. A cash incentive is being offered to the farmers to wean them away from stable burning. Farmers in Punjab, who do not burn paddy straw will get a compensation of Rs. 2500 per Acre. The compensation will be paid in equal parts of Rs. 500 per Acre each by the Punjab and Delhi Governments. While Rs 1500 per Acre will be paid by the Centre, was announced in 2021.

Case Study:-

The burning of paddy straw directly contribute to environmental pollution and are also responsible for the haze and smog in Delhi and melting of Himalayan Glaciers. In first week of November 2016, in an event known as the great Smog of Delhi, the air pollution spiked for beyond acceptable levels. Levels of PM_{2.5} & PM₁₀ (particulate matter) hit 999 micrograms/cubic meter, While the safe limits for those pollutants are 600 (60-100), respectively (Indian express 2017).

On 15th November, 2021, Delhi's air quality saw marginal improvement as it reached the lower end of the very poor category with air quality index (AQI) ^{at} 318. According

the System of Air Quality and whether forecast -Ing and Research (-suffir) (SAFAR). Delhi CM, Arvind Kejriwal had announced to shut all the schools along with government offices for a week due to severe air pollution. Again, the air quality of Delhi on 18th Nov. 2021 slipped to the 'very poor' category with the air quality index at 362. The Supreme Court of India reprimanded the central and State Governments asking them to take strict measures to reduce pollution in Delhi and NCR Regions.



Unit - 5

The Environment (Protection) Act, 1986
The Act came into force on November 19, 1986, the 60th anniversary of our late Prime Minister Indira Gandhi, who was a pioneer of environmental protection issues in our country. The act extends to whole of India. Some terms related to environment have been described as follows in the act:

(i) Environment *

It includes water, air and land and the inter-relationships that exist among and between them and human beings, all other living organisms and property.

(ii) Environmental Pollution *

The presence of any solid, liquid or gaseous substances present in such concentration, as may be injurious to environment.

(iii) Hazardous Substance *

Any substance or preparation which by its physico-chemical properties or handling is liable to cause harm to human beings, other living beings, organisms, property or environment.

The most important functions of central Government under this Act include:-

- (1) The standards of quality of air, water or soil for various areas and purposes.
- (2) The maximum permissible limits of concentration of various environmental pollutants (including noise) for different areas.
- (3) The procedures and safe guards for the handling of hazardous substances.
- (4) The prohibition and restrictions on the handling of hazardous substances in different areas.
- (5) The prohibition and restriction on the location of industries and to carry on process and operations in different areas.

For the purpose of protecting and improving the quality of the environment and preventing and mitigating pollution, standards have been specified under Schedule I-IV of environment protection act, 1986. The maximum permissible limits of B.O.D (Biochemical Oxygen Demand) of the waste water is 30 ppm if it is discharged into in land waters, 350 ppm if it is discharged into a public sewer and 100 ppm, if discharged on to land or coastal region. It is the duty of the pollution control Board to check whether the industries are following the prescribed norms or not.

Under the Environmental (Protection) Act 1986. The state pollution control Boards have to follow the Guidelines provided under schedule - I, some of which are as follows:

- (1) They have to advise to industries for treating the waste water and gases with the best available technology to achieve the prescribed standards.
- (2) The industries have to be encouraged for recycling and re-using the wastes.
- (3) They have to encourage the industries for recovery of biogas, energy and reusable materials.
- (4) While permitting the discharge of effluents and emissions into the environment, the State Boards have to take into account the assimilative capacity of the receiving water body.
- (5) The Central and State Boards have to emphasize on the implementation of clean technologies by the industries in order to increase fuel efficiency and reduce the generation of environmental pollutants.

Under the environment protection rules 1986 and ammendments was made in 1994 for Environmental Impact Assessment (EIA) of various development Projects. There are 29 types of Projects listed under schedule I of the rule which require clearance from the central Government before establishing.

Under the (environment protection act), 1986, there are 18 hazardous waste categories recognised under this rule and there are guidelines for their proper handling, storage, treatment, transport and disposal which should be strictly followed by the honour.



The Environment Protection Act, 1986 has also made provision for environmental audit as a means of checking whether or not a company is complying with the environmental laws and regulations. Thus, ample provisions have been made in our country through law for improving the quality of our environment.

Environmental Protection

Environmental legislation

India is the first country to have made provision for the protection and conservation of environment in its constitution.

On 5th June, 1972, environment was first discussed as an item of international agenda. In United Nations (UN) conference on Human Environment in Stockholm and thereafter, the 5th June is celebrated all over the world as World Environmental Day.

Constitutional Provisions

The provision for Environmental Protection in constitution of India was made within the 4 years after the Stockholm conference.

In 1976, 42nd amendment under the Article 48-A & 51-A (g) in our constitution which includes environmental protection and conservation as one of our fundamental duties.



Just after the stockholm conference, following Acts are passed for our country.

- ① Wildlife (Protection) Act, 1972
- ② The Water (Prevention & Control of Pollution) Act, 1974
- ③ The Forest (Conservation) Act, 1980
- ④ The Air (Prevention & Control of Pollution) Act, 1981
- ⑤ The Environment (Protection) Act, 1986.

India is the first country in the world which has provision for environmental conservation in its constitution (48-A and 51-A(g)). This Act identifies environmental protection and conservation as of ~~over~~ our fundamental duties.

In India there are more than 200 Central/State Laws for Environmental Protection. These are related to different aspects of environment. Most of the laws are highly relevant for Environmental conservation but unfortunately, due to poor enforcement, they remain ineffective. Major reason for failure of these laws in the common people generally they remain unaware about Environmental Law or do not take interest in applying them in the administrative frame work in India for protection and conservation of environment as shown in figure below:-



Central Government

- Ministry of Environmental & Forest (MOEF)
- The Central Pollution Control Board (CPCB)
- Regional Offices



State Government

- Department of Environment
- The state Pollution Control Board (SPCB)
- Regional Offices

Others

- Non Gov. Agency (NGO)
- Universities
- Technical universities
- Research Institute



Ques 1 What is the role of government in environmental protection and conservation?

There are the following major role of government in the Environmental Protection and conservation include :-

- 1- Making Environmental Policies and implementing them.
- 2- Conservation of forest and different natural resources through institutional framework.
- 3- Monitoring the Pollution level across the country through Pollution control Board/Agencies.
- 4- Conducting large scale pollution control Program that is Ganga Action Plan and Yamuna action Plan (YAP).
- 5- Running municipality and solid waste dumping for the disposal of Urban Waste.
- 6- Promoting Environmental Education at a level (School, college, Institute) and promoting Research and Development (R & D) in Environmental field.
- 7- To Encourage zero discharge from the Industries.
- 8- Awareness & regarding personal health and risk.
- 9- The Government must play Active Role in the protection and conservation of Environment.

Ques 2 What are the strategies/Policy of Government of India against Women Education.

Ans* There are the following strategies/ Policy of Government of India for promoting Women Education.

- 1- The 86th ammendment of constitution has made elementary education are fundamental right for the children between 6-14 years.
- 2- Balika Samruddhi Yojana (BSY) :-
To encourage enrolment of girls in school
- 3- Indira Mahila Yojana (IMY)
Women empowerment by forming groups.
- 4- Mahila Samruddhi Yojana (MSY) :-
To encourage habit of savingⁱⁿ women.
5. Rashtriya Mahila Kosh (RMK) :-
For credit need of women.
6. Reservation of Seats in Institute of Higher Education.
- 7- The program of development of women and children to improve socio economic activity condition of rural women.

Role of Women Education in Environmental Protection and Conservation.

- (1) She can raise interest of her family member toward education, education will enhance awareness toward the prevention of natural resources.



- (2) She can easily motivate other women.
- (3) She can discuss about family planning and prevention measures.
- (4) She can conduct different campaign of health care, environmental protection and conservation for local peoples who are located in the urban and rural areas.
- (5) She can organise fund through donation for social activities.

Obstacles:-

Gender discrimination still present in India and lot more needs to be done in the field of women's education in India. The gap in the Male / Female Literacy rate is just a simple indicator. While the Male literacy rate is more than 84% according to the 2021 census, the Female literacy rate is just 71.5%. Prevailing Prejudices, low enrollment of girl child in the school, Employment of girl children in domestic works and High drop out rate are major obstacles in the path of making all Indian women educated.

Ques → Explain population growth curve (exponential & sigmoidal growth curve).

Ans → One of the Darwin's important observation was that a population never continuously grew exponentially or rapidly forever. There is the

resistance from the environment as the food supply decreases and the number of predators and pathogens increases. All the living organisms need some specific resources such as nutrients and proper environmental conditions to survive and reproduce.

Types are the following two types of population growth curve:

- ① Exponential Growth curve (J-shaped growth curve)
- ② Sigmoidal Growth curve (S-shaped growth curve)

(1) Exponential Growth curve

In this type of growth, the population grows in exponentially, and after attaining the peak value the population may abruptly crash. The increase in population is continued till large amount of food materials exist in the habitats. Later on, due to increase in population size the food supply in the habitat becomes limited which ultimately results in decrease in population size. The following equations exhibit J-shaped growth: $\frac{dN}{dt} = rN$

where, $\frac{dN}{dt}$ = Rate of change in population

r = Biotic potential.

N = Population size.

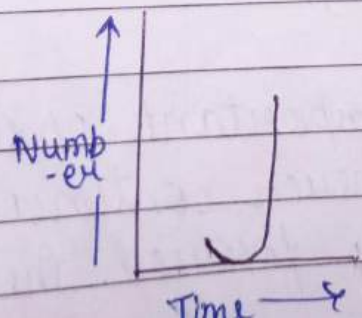


Fig: J-shaped growth curve

Note:- Biotic potential = the maximum no. of individuals a species can produce.

(2) Sigmoidal Growth Curve (S-shaped growth curve) - This sigmoid growth curve is also known as logistic growth curve which is S-shaped. When an organism is introduced in an area, the population increase is very slow in the beginning i.e. the positive acceleration phase or lag phase. In the middle phase the population increase becomes very rapid which is known as log phase, the population increase is slowed down i.e. negative acceleration phase. The level beyond which no major increase can occur is referred to as saturation level or carrying capacity which is represented by K.

The following equations exhibit S-shaped growth

$$\begin{aligned} \frac{dN}{dt} &= rN (K - N/K) \\ &= rN (1 - N/K) \end{aligned}$$

- where, $\frac{dN}{dt}$ = rate of change in population
- r = Biotic potential
- N = Population size
- $K - N/K$ = Environmental resistance

Carrying Capacity

The carrying capacity of a biological species in an environment is the population size of the species that the environment can sustain indefinitely, given the food, habitat, water and other resources available in the environment. Which (Carrying capacity) is represented by K .

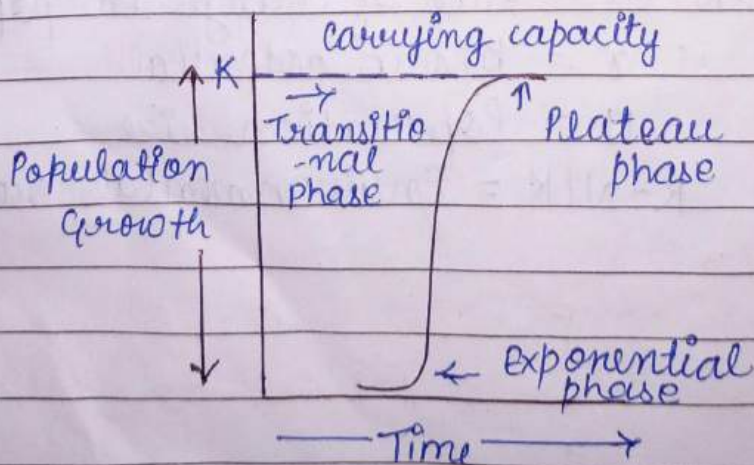
Biotic Potential →

Biotic Potential is the maximum number of individuals a species can produce. Biotic potential is represented by r .

Environmental Resistance ($K = N/K$) →

It is the sum of the environmental factors (drought, mineral deficiencies and competition) that tend to restrict the biotic potential of an organism.

Sigmoidal Growth Curve





Initiative by the non-government organizations (NGO's) →

- (1) A non-governmental organization (NGO) is a group that functions independently of any government. It is usually non-profit NGO's, sometimes called civil society organizations, are established on community, national, and international levels to pursue a social or political goal such as a humanitarian cause or the protection of the environment.
- (2) NGO not only focus on environmental issues but also for environmental protection and conservation.
- (3) NGO create awareness amongs the public on current environmental issues and possible solutions and also protect natural resources.
- (4) Organizing seminar, lecture and group discussion for promoting the environmental awareness toward environmental protection and conservation.
- (5) Use of biofertilizers and biopesticides improve agriculture. They are both are environment friendly.
- (6) They education people for re-use and recycle of waste material.



There are several national and international NGO's :

- (1) Indian Environmental Society (1972)
- (2) Wildlife Trust of India (1998)
- (3) World Wildlife Fund (1961)
- (4) Greenpeace (1971)

(1) Indian Environmental Society (1972) →

This organization is starting in 1972 to promote environmental improvements in India. Indian Environmental Society (IES) focus on environmental education, biodiversity conservation and solid waste management.

(2) Wildlife Trust of India (1998) →

This organization is established in 1998 to conserve the declining wildlife in India. They mainly focus on animal welfare, wildlife conservation and animal protection. They work to conserve wildlife and their habitat.

(3) World Wildlife Fund (1961) →

It is established in 1961. The mission of it to conserve nature and minimize the threats to the diversity of life on the earth.

Thus the NGO further more conserve the natural resources and protect the rare species.

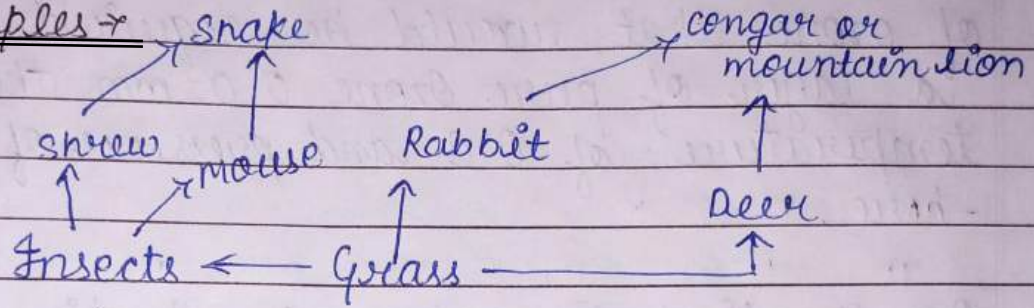
(4) Greenpeace (1971) →

It is established in 1971. It established by group of people who work, trying to stop United States (US) nuclear weapon test in Alaska.

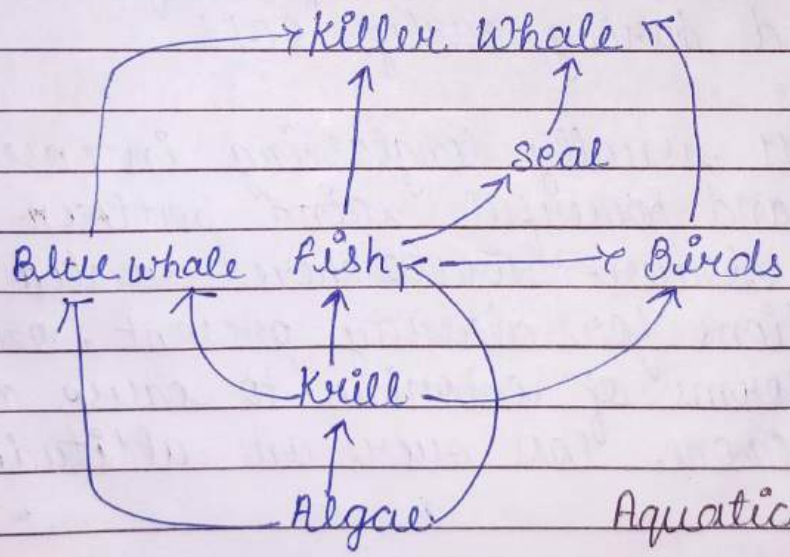
Replace in old Unit-1

Food Web →

Examples →



Terrestrial Food Web :-



Aquatic Food Web.

Some important Key Points :-

- (1) The Dobson unit is named after Gordon Dobson who in the 1920's built the first instrument to measure total ozone from the ground.
- (2) One Dobson unit is the number of molecules of ozone that would be required to create a layer of pure ozone 0.01mm thick at a temperature of 0°C and pressure of 1 atmosp - here.
- (3) For the first time above the Arctic, a very large hole (thinning of ozone beyond certain level), almost five times the size of California, has been reported during early 2011.
- (4) In March 2011 usually longlasting intense cold temperature and powerful wind pattern in the Arctic's lower stratosphere created the right conditions for already present, ozone destroying forms of chlorine to cause more than 80% ozone loss over an altitude of 18 to 20 kms.
- (5) The findings published in the general Journal Nature, reveal that the hole is formed over Northern Russia, parts of Greenland and Norway. This means that people in these areas are likely to be exposed to high levels of ultraviolet radiations.



Nobel Peace Prize

2004 and 2007 for environmentalist the 2004 Nobel Peace Prize for Kenyan Environmentalist Wangari Maathai for her contribution to sustainable development, democracy and peace. This is the greatest recognition given to the cause of environment at international level.

Nobel Peace Prize 2007 was awarded jointly to Inter-governmental Panel on Climate Change (IPCC) headed by Indian Environmentalist Dr. R.K. Pachauri and former United State Vice-President Al Gore. IPCC, the UN body comprising of 3000 experts from various fields in an authority on Global Warming and its impact. The award to IPCC is an appreciation of its efforts to build-up and disseminate greater knowledge about man-made climate change and to lay the foundation for the measures that are needed to counteract such a change.



Biomagnification

Biomagnification is the increase in concentration of an element or compound, such as pesticides (DDT) that occurs in a food chain as a consequence of food chain energetic; or lack of or very slow, excretion or degradation of the substance.

Salinisation

Salinisation refers to a buildup of salts in soil, eventually to toxic levels for (3000 to 6000 ppm) salt results in trouble for most cultivated plants). Salts in soils decreases the osmotic potential of the soil so, that plants cannot take up water from it. When soils are salty, the soil has greater concentrations of solute than does the roots, so plants cannot get water from the soil.

Peroxyacetyl nitrate (PAN)

Peroxyacetyl nitrate is a secondary pollutant and primarily responsible for damage to plant life and leads to the formation of photochemical smog which results in which results in eye irritation in human being.

For example:- photochemical smog

$\text{HC}_x + \text{NO}_x \rightarrow \text{Photochemical smog}$

$\text{NO}_x \rightarrow \text{Oxides of nitrogen}$

'photochemical smog' is a combination of Hydrocarbon and oxides of Nitrogen.

Chloroform carbons (CFC's) &

Chloroform carbons are ozone depleting substances such as halons (Bromo fluoro carbons) and Methyl bromide. In certain circumstances the chlorine or bromine from these substances can react with ozone to form it back into oxygen.

MTC (Methyl isocyanate)

Methyl isocyanate is a potent toxicant and was released into the atmosphere in Bhopal on December 3rd, 1984 at midnight from a pesticide manufacturing plant (Union Carbide factory). Due to the alleged functional failure of scrubber outlet resulting in the death of about 1 lakh people and severe disability of an additional 1 lakh of the city's population.

Difference b/w BOD and COD

BOD (Biochemical oxygen Demand)
The Biochemical oxygen demand is a measure of the oxygen required by aerobic microorganism to biochemically oxidise the organic matter.

(COD) Chemical oxygen demand
Another quick measure of organic matter present in waste is chemical oxygen demand (COD). and this uses chemical oxidant (Potassium dichromate in Acetic condition).

present in the water waste and is expressed in mg/litre.

are used instead of Aerobic microorganisms - sm for the oxidation of organic matter.

Pyrolysis & Composting

In pyrolysis the solid waste are heated under anaerobic conditions and aerobic condition burning without oxygen. The organic components of the solid wastes split-up into gaseous liquid and gaseous fractions $[CO]$, $[CO_2]$, $[CH_4 \text{ methane}]$ and $[TAR]$ where as composting is one of the oldest forms of disposal. It is the natural process of decomposition of organic waste that yield manure or compost, which is very rich in nutrients. Composting is a biological process in which micro-organisms, mainly fungi and bacteria converts degradable organic waste into humous like substance.

London Smog

This type of smog is thought to be caused by sulphur dioxide $[SO_2]$. It is formed by combination of smoke, dust, fog and SO_2 . Chemical smog is usually formed around some industrial and power plants it is generally bad in the early morning hours and becomes worse after sunrise, due to sunlight induced oxidation of SO_2 to SO_3 followed by reaction with humidity sulphuric acid is formed in



this type of smog, which is very harmful to people suffering from bronchial diseases such as Asthma or Emphysema.

On Thursday, December 04, 1952 a high temperature air mass moved over southern England and thus creating a temperature inversion which cause a white fog to settle over London. As the particulate and sulphur dioxide level rose due to extensive use of coal fired heating and power production system, the fog began to blacken. The high pressure area stalled and the pollutant build-up worsened further, since there were no air currents to disperse the smog. By Friday morning, visibility was zero. According to any eye witness such was the state that white collar became almost black within 20 minutes.

The smoke so formed, was intensely irritating to the human respiratory systems. As a result, most of the people soon developed red eyes, irritation in throats and cough. Soon reports on smog related to deaths began to come in the elderly and the people with chronic respiratory problems. became the first casualty followed by young and otherwise healthy persons. More than 4000 people died before the fog disappeared / lifted on December 09, 1952.

Page _____
Date _____

Net Primary Production (NPP) & Gross Primary Production (GPP) →

The producers are left with a little less organic matter than what was actually produced by them. This is known as the net primary production (NPP) and the respiratory loss (R added to it gives) the gross primary production (GPP).

$$\begin{array}{ccc} \text{NPP} + \text{R} & \rightarrow & \text{GPP OR} \\ \downarrow & & \text{GPP} - \text{R} = \text{NPP} \end{array}$$

where, R = respiratory loss

Los Angeles Smog or Photochemical Smog →

Photochemical smog is associated with adverse meteorological conditions when air movement is restricted in summers in highly motorized areas. The first noticed incidence of photochemical smog was in Los Angeles, USA, in the mid 1940's and thus it is sometimes called Los Angeles Smog.

Photochemical smog is a mixture of reactants and products that result from the interactions between volatile organic compounds (VOC's) and oxidants such as NO_x , O_3 , CO. The primary pollutants in photochemical smog are nitric acid oxide and hydrocarbons. These primary pollutants convert rapidly to the secondary pollutants like ozone, organic nitrates (peroxy acetyl nitrate), oxidized hydrocarbons and photochemical aerosols in the presence of sunlight it is characterised by brown and

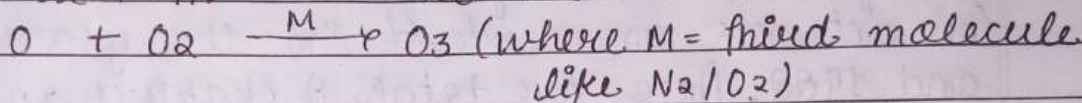
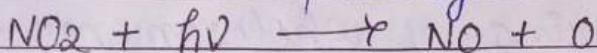


hazy fumes which reduce visibility, cause eye and lung irritation, damage crops, leads to the cracking of rubbers, damage of plants etc.

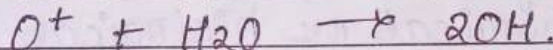
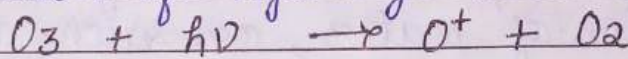
In India, Mumbai and Kolkata are ideal conditions for the formation of photochemical smog, but it may be masked by smog and SO_2 .

There are many complex reactions which take place in the formation of photochemical smog.

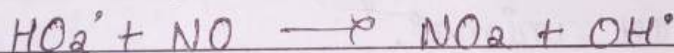
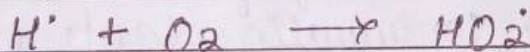
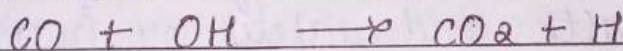
Normal NO_2 photolytic cycle.



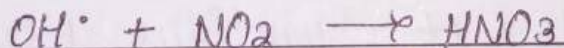
Production of hydroxyl radical



Chain and disturbance reactions \rightarrow



Termination Reaction \rightarrow



Photochemical smog is oxidising smog and it should be clearly distinguished from the London smog which forms due to the combination of smoke and fog.

Differentiate between fog and smog

Fog is special type of thin cloud consisting of microscopically small water droplets which are kept in suspension in the air near the



ground surface water where as smog (smog + fog) is two types one is found in places having coal as the principle fuel. the other one is photochemical smog.

18741 The Water (Prevention & Control of Pollution) Act 1974 *

The Water Act was enacted by Parliament Act, 1974 purpose to provide for the prevention of control of water pollution and the maintaining or restoring of wholesomeness of water. The act was ammended in the years 1978 and 1988. There are total 8 chapters and 64 sections. Water pollution is defined as such contamination of water, or such alteration of physical, chemical or biological properties of water which is harmful or injurious to public health and safety or harmful for any other use or to aquatic plants and other organisms or animal.

Under Section 16 & 17: Functions of Central & State Boards *

The Central and State Boards may performed the following functions, namely.

- 1- Advise the ~~total~~ central government on any matter concerning the prevention and control of water Pollution.
- 2- Co-ordinate the activities of the State Boards and Resolve disputes among them.



- 3- Organise through mass media, a comprehensive program regarding the prevention and control of water pollution.
- 4- Plan and cause to be executed, a nation wide program for the prevention, control or abatement of water pollution.
- 5- To plan a comprehensive program for the prevention, control or abatement of pollution of streams and wells in the State and to secure the execution thereof.
- 6- To advise the State Government's on any matter concerning the prevention, control or abatement of water pollution.
- 7- To collect and disseminate information related to water pollution and the prevention, control or abatement thereof to encourage, conduct and participate in investigations and research related problems of water pollution and prevention control or abatement of water pollution.

Ans-43 The Wildlife Protection Act, 1972

This Act came into force on September 09, 1972. An act to provide for the protection of wild Animals, Birds and plants and for matter connected therewith with it contains seven chapters, six schedules and 66 sections. It extends to the whole of India except the state of Jammu and Kashmir. It shall come into force in a State or Union Territory to which it extends, on such date, as the Central government may by the

notification, appoint and different dates may be appointed for different provisions of this Act or for different States or Union territories. The major activities and provisions in the Act can be summed up as follows:

- 1- It provides for the appointment of wild life advisory Board.
- 2- Protection of some endangered species.
- 3- Chief Wildlife Warden (CWW) may grant a permit to any person in writing, stating the regions on payment of such fee that is prescribed for the purpose of education, scientific research, scientific management, collection of specimens, collection or preparation of snake-venom for the manufacture of life saving drugs.
- 4- No person shall willfully pick, uproot, damage, destroy or collect any specified plant from any forest land and any area specified or notification by the central government.
- 5- The Act provides the declaration of century and National Parks under section-38.
- 6- This Act gives the power of central government and State Government to make rules.

40 The Forest (conservation) Act, 1980

An act to provide for the conservation of forests and for matters connected therewith or incidental thereto. It extends to the whole of India except the State of Jammu and Kashmir.

It shall be deemed to have come into force on October 25, 1980.

Under section-2:- Restrictions on the Devise/Reservation of forests or use of forest land for non-forest purpose.

The Forest Conservation Act or any other law for the time being in force in a state, no State Government or other authority shall make, except with the prior approval of the Central Government, any order directing:-

- 1) That any forest land or any portion of forest may be used for non-forest purpose.
- 2) That any forest land or any forest portion may be assigned by way of lease or otherwise to any private person or to any authority, corporation, agency or any other organization not owned, managed or controlled by Government.
- 3) That any forest land or any portion of forest may be cleared of trees which have grown naturally in that land, for the purpose of using it for reforestation.

Under section-3: Constitution of advisory committee.

The Central Government may constitute a committee consisting of such number of persons as he may deem fit to advise that Government with regard to:

- 1- The Grant of approval, under section: 2. and
- 2- Any other matter connected with the conservation

of forests which may be reserved by the Central Governments.

Under Section - 3A: Penalty for contravention of the provisions of the Act ✖
Penalty for the contravention of any of the provisions of section 2 shall be punishable with simple imprisonment for a period which may extend to 15 days.

Under Section 4: Power to Make rules:-

The Central Government may, by notification in the official gazette, make rules for carrying out the provisions of this Act.

Under Section 5: Repeal & Saving ✖

- 1- The Forest conservation ordinance, 1980 is here by replaced. Some ammendments are made in forest Act in 1992 :-
- (1) Cultivation of Tea, Coffee and Rubber are included under non-forestry Activity.
 - (2) Exploration and servey of National Park and Wildlife Countries are totally prob prohibitet.

Global Warming Potential (GWP) ✖

Global warming potential is an index to measure of how much infrared thermal radiation and longer wave solar radiation, a green house gas would absorb over a given time frame after it has been added to the atmosphere (or emitted to the atmosphere).

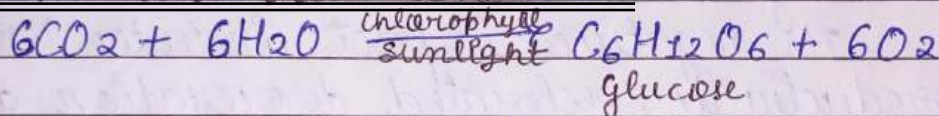


Photoautotrophs & Chemoautotrophs

These are mainly green plants, which can synthesize their food themselves by making use of carbon dioxide (CO_2) present in the air and water in the presence of sunlight by enclosing chlorophyll, the green pigment present in the leaves, through the process of photosynthesis. They are also known as photoautotrophs.

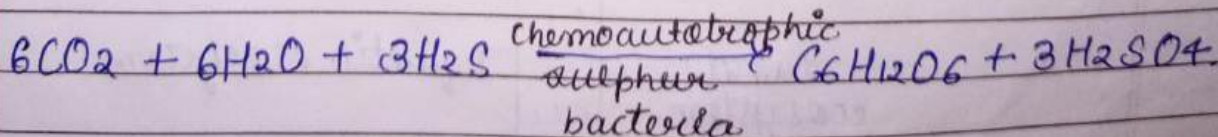
\downarrow \downarrow \downarrow
 light Self foods

Chemical reaction



Chemoautotrophs - There are some microorganisms also which can produce organic matter to some extent through oxidation of certain chemicals in the absence of sunlight. They are known as chemosynthetic organisms or chemoautotrophs. For instance in the oceans depths, where there is no sunlight, chemoautotrophic sulphur bacteria make use of the heat generated by the decay of the radioactive elements present in the earth's core and released in oceans depth. They use this heat to convert dissolved hydrogen sulphide (H_2S) and carbon dioxide (CO_2) into organic compounds.

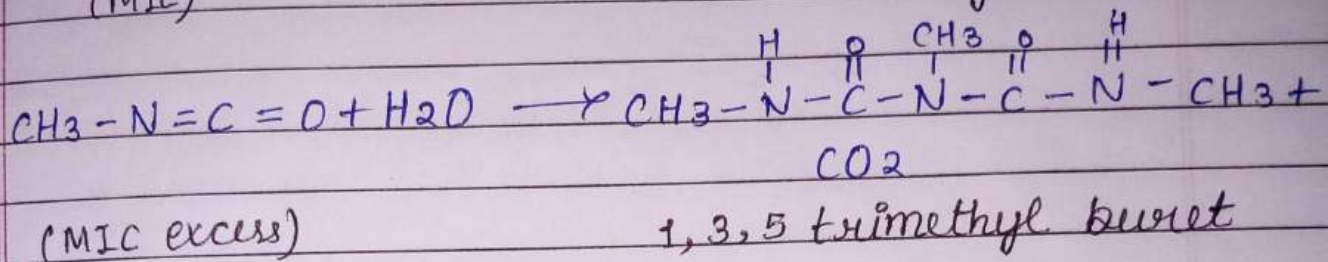
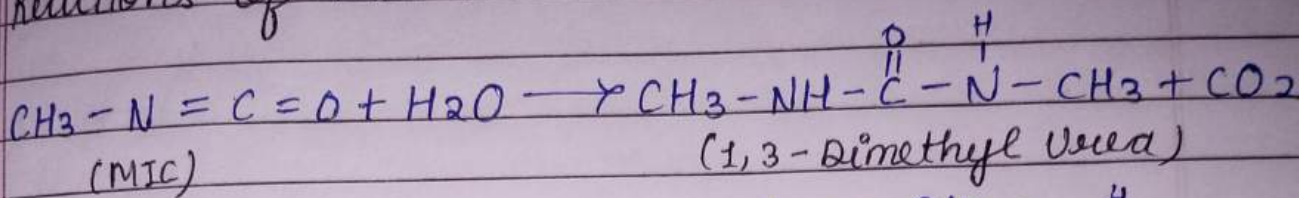
Chemical reaction





BHOPAL GAS TRAGEDY →

Reactions of MIC →



Exothermic reaction which leads to an increase in pressure which caused the safety valve to burst & the gas leaked out.