

UNIT-1 ES
The Multidisciplinary Nature of environment studies ①

→ Environmental studies deals with environmental issues that effects an organism. It is a multidisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems.

→ Its components include biology, geology, chemistry, physics, engineering, sociology, health, statistics, anthropology, economics, computers and philosophy.

→ The scope of environmental studies is very wide and it deals with many areas like.

- (i) conservation of Natural resources.
- (ii) Ecological aspects → means balance
- (iii) pollution of the surrounding natural resources.
- (iv) controlling the pollution.
- (v) social issues connected to it.
- (vi) impact of human population on the environment.

→ our daily lives are linked with our surrounding and inevitably affects them. our dependence on nature is so great that we cannot continue to live without protecting the earth's environment resources.

(2)

→ The industrial development and intensives agriculture that provides the goods for our increasingly consumer oriented society, use up large amount natural resources. Such as water, minerals, petroleum products, wood etc.

→ Natural Resources.

* A natural resources is what people can use which comes from natural environment. Example of natural resources are air, water, wood, oil, wind energy, natural gas, iron and coal etc.

→ * Renewable Resources:-

Such as timber and water are those which can be used but can be regenerated by natural processes such as regrowth of rainfall.

* Non Renewable resources:-

Such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations.

ex:- Coal, petrol.

* Sustainable utilisation or development:-

Sustainable development is development that meets the needs of the present without compromising the ability of future

(3)

generations to meet their own needs

→ we live in a world in which natural resources are limited. water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and live stock, are all a part of our life support system without them life itself would be impossible.

Importance of Natural Resources:

- (i) Natural resources are important and without which things cannot survive in the world.
- (ii) Every sector of the national economy like agriculture, industry, transport, commercial and domestic needs inputs of resources.
- (iii) They play a vital role in the economic development of the country by enriching agriculture, trade, imports and exports etc.
- (iv) As natural resources are scarce with the growing population, it is necessary to conserve them and this enables us as well as the future generation to utilise the natural resources to the full extent.

→ Need for public Awareness!

* As we all know that the earth's natural resources are decreasing day-by-day we should do something to make them protect or conservation of natural resources.

* If we talk about Individually we can play a major role in environment management. we can reduce wasting natural resources and we can act as watchdogs that inform the government about sources that lead to pollution and degradation of our environment. This can only be made possible through mass public awareness.

* mass media such as newspaper, radio, TV, etc. strongly influence public opinion.

→ Some important points need to Aware, to manage natural resources!

A population of over thousands of millions is growing. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduce the gains of development. Hence, the greatest challenge before us is to limit the population growth.

⊕

* ~~poor~~ poverty, the vast majority of our people all directly dependent on the natural resources of the country for their basic needs of food, fuel, shelter and fodder. Environment degradation has adversely affected the poor who depend upon the resources of their immediate surrounding.

* Need to protect and stop wastage of surface water as well as ground water.

* Need to protect / conserve wild life and forest life called biodiversity hotspot.

* Grow more trees, join local movement that support activities such as saving trees.

Institutions in Environment

* There have been several government and non-government organizations that have led to environmental protection in our country. They have led to growing interest in environmental protection and conservation of natural resources and nature.

⑥

* The large number of institutions that deal with environmental protection and conservation a few well-known organizations include government organizations such as

- (1) Bombay Natural History Society (BNHS) (Mumbai)
- (2) World Wide Fund for Nature (WWF-I) (New Delhi)
- (3) Center for Science and Environment (CSE) (New Delhi)
- (4) Center for Environment Education (CEE) Ahmedabad.
- (5) Kalpana Chawla (Pune)

people in environment

→ There are several internationally known environmental thinkers. Among those who have made landmarks, the names that are usually mentioned are:-

* Charles Darwin wrote the 'Origin of Species' which brought to light the close relationship between habitats and species. It brought about a few big changes or new thinking of man's relationship with

other's species that was based on evolution.

- * Indira Gandhi as PM has played a highly significant role in the preservation of India's wild life.
- * S.P. Godrej was one of India's greatest supporters of wild life conservation and nature awareness programme. Between 1975 and 1999 he received 10 awards for his conservation activities.
- * M.S. Swaminathan is one of India's foremost agricultural scientists and has also been concerned with various aspects of biodiversity conservation both of cultivated and wild biodiversity.
- * Sunderlal Bahugna's Chipko movement has become an internationally well known example of a highly successful conservation action program through the efforts of local people for guarding/guarding their forest resources.

Unit-2 NATURAL RESOURCES

→ our environment provides us with a variety of goods and services necessary for our day to day lives. Natural Resources include air, water, soil, minerals along with the climate and solar energy which form the non-living or abiotic part of nature. The biotic or living parts of nature consists of plants and animals including microbes.

→ interactions between the abiotic aspects of nature and specific living organisms together form ecosystem.

Global Environment:-

In ecosystem "eco" means environment and system means interesting complex structure. It is regarded as a functional unit of measure where living things interact among themselves and with some non-living things (abiotic).

Classification of ECOSYSTEM

Broadly classified into two categories.

- ① natural
- ② ~~no~~ man-made (synthetic)

Natural:-

(a) aquatic (exist in water bodies)	(b) Terrestrial- (exists in forest/ grasslands/desert)
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② man-made:- dams, bridges etc.

Study of ecosystem is known as ecology.

It is derived from two Greek words
oikos → house/habitat.
logos → to study.

→ Ecology is classified into two categories.

① Autoecology
(particular
species)

② ~~Syn~~ synecology.
(group of species)

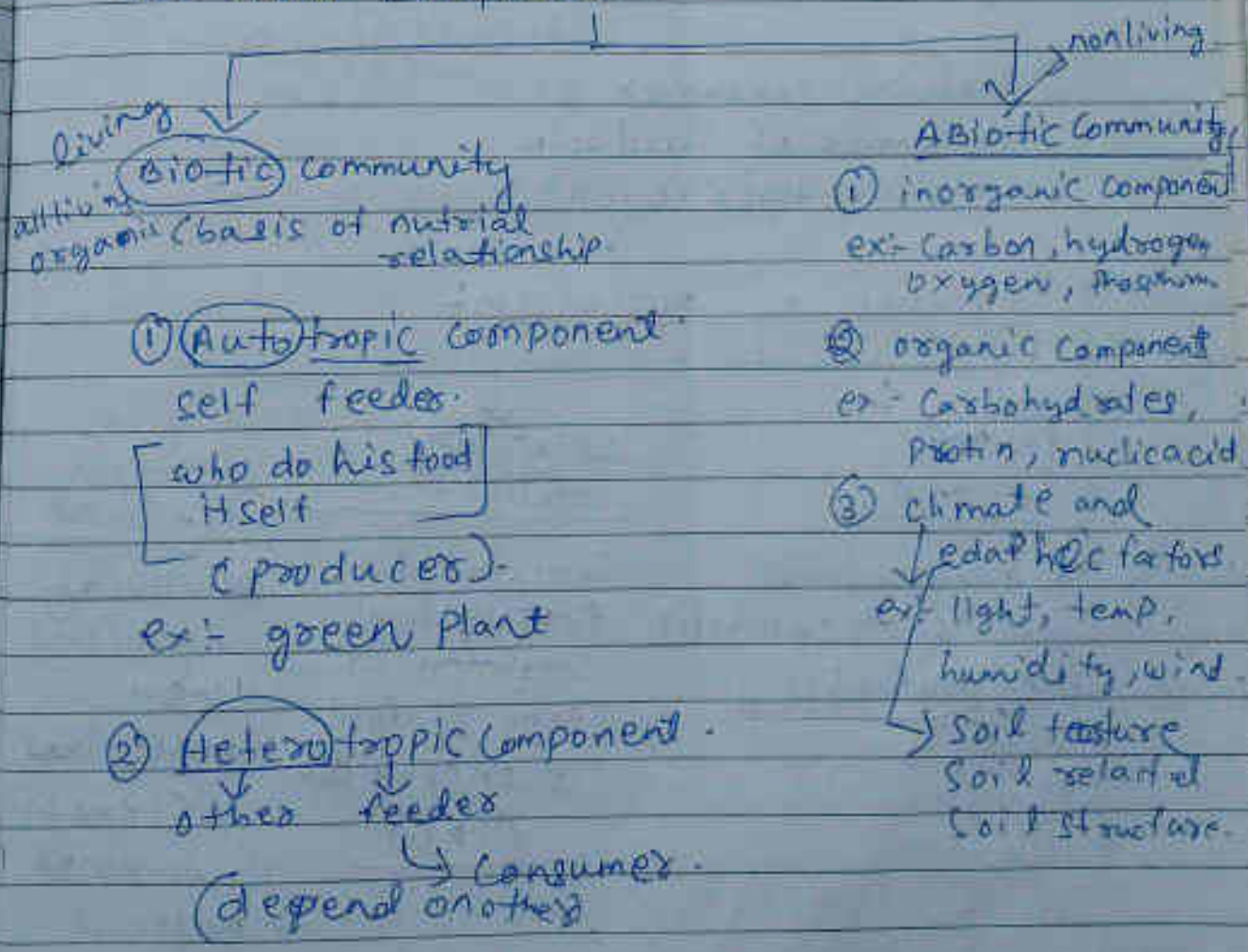
Ecosystem → definition
→ structure
→ function.

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- A biotic community lives in abiotic environment
(living) (nonliving)
called Biotope.
- Biotope provides material as well as energy to biocommunity inhabit it.
- This shows there is an interaction b/w biotic community and its environment.
- A biotic community and its biotope together called ecological system or ecosystem.
- Term ecosystem → A.G. Tansley
→ 1935

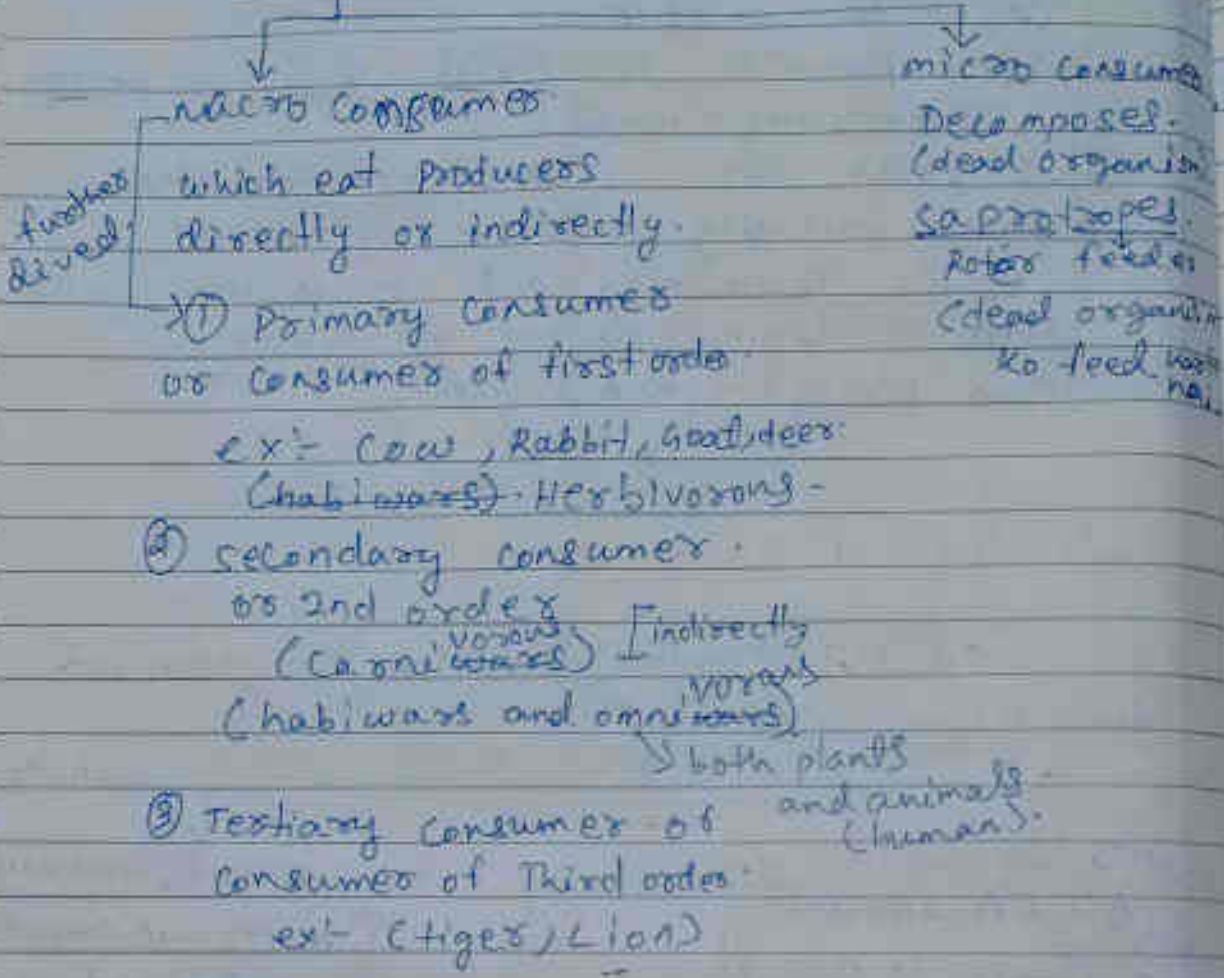
Structure of ecosystem

Odum (scientist) divided ecosystem into two main components.

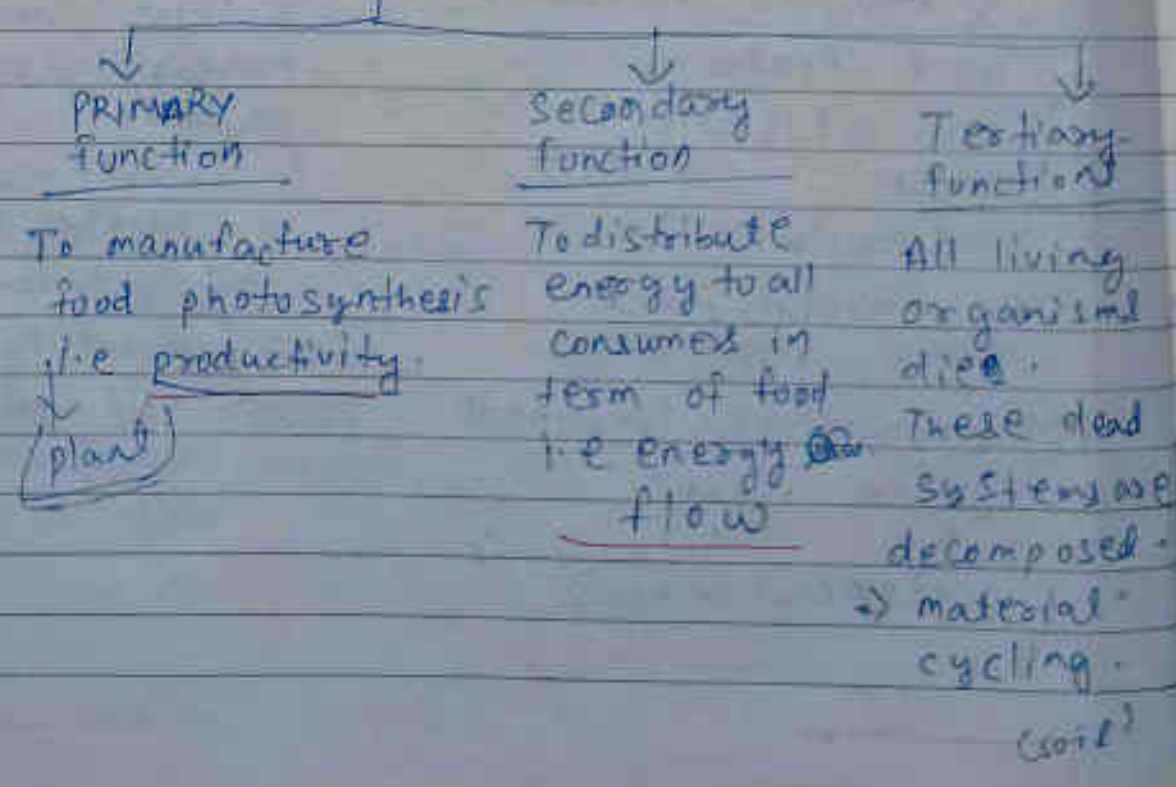


detrivorous (decomposes)

Heterotrophic



Function of ecosystem:



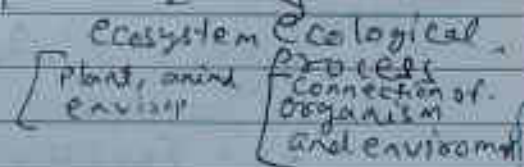
Biodiversity

Concept - combination

- Analogy of two words - Biological and Diversity → variety
- The variety of life found on the Earth.
- Term was coined by Walter A Rosen 1985.
- Comprises of all species of plants, animals, microorganism and the ecosystems and ecological process.

Definition -

Biodiversity can be defined as vast array of species of microorganisms, algae, fungi, plants and animals occurring on earth when in terrestrial or Aquatic habitats and ecological complexes of which they are part.



SCOPE

- medicinal field.
- industries
- Research.
- environment.
- environment conservation.
- Job opportunity.

omnivorous
herbivorous
carnivorous

Levels of Biodiversity

Genetic Diversity -

- variation of genes within species.
- genes - carriage of Heredity from parents to offspring and contains

10 ek duse ke
sath haido ke
sath haido ke

and contain information that determine the characteristics of each organism.

Species Diversity :-

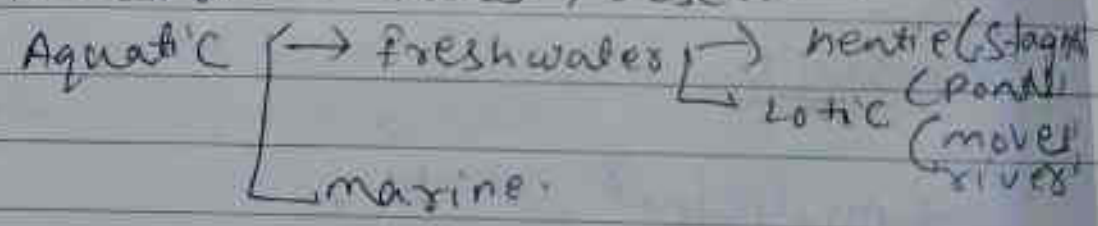
- variety of species within a region.
- species = group of organisms capable of interbreeding.

ex: Tiger - Panther or tiger.
Lion - panther Leo
snow Leopard - panther - unicia
 genes species

Ecosystem Diversity

Ecosystem = ~~biotic~~ Biotic components + Abiotic component.
(interaction betⁿ)

ex: Terrestrial: forest, deserts ..



Conservation of Biodiversity

food chain

Food chain is the flow of food energy from one organism to next and so on.

starts → Producers → Carnivorous → ends.

Grass → Grass hoppers → rat → snake → Hawk
(Producers) (Primary Consumed) (Secondary Consumed) (Tertiary Consumed)

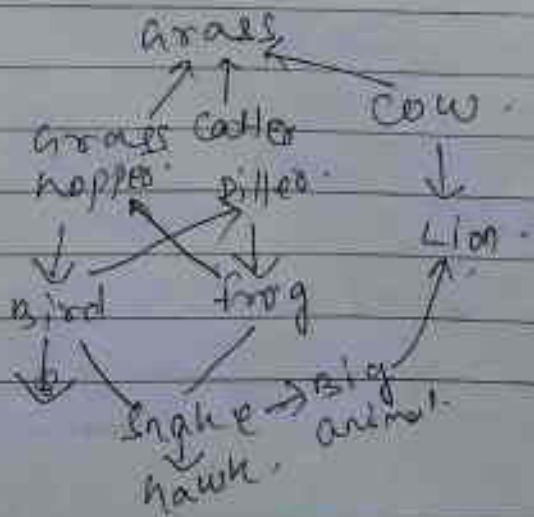
Grass → moth → Sparrow → snake → hawk.

Tree → moth → Bird → Eagle.

snake / Hawk → after dead decomposed.
fungi, bacteria
Soil, light, water.

Food web

Food web is a group of several interconnected food chains. Organisms get food from more than 1 group of organism.



POLLUTION

1

> Pollution is the excessive addition of undesirable substances into the environment thereby causing damage plants, animals & human beings and also adversely affecting the natural quality of the environment.

> The undesirable substances are called "Pollutant".

Classification of Pollutants :-

Classification - 1

Based on physical state of the pollutant.

(i) Solid pollutant :- dust, smoke, fly ash, lead particles (suspended particulate matter).

(ii) Liquid pollutant :- Acid or Base in water.

(iii) Gaseous pollutant :- CO, CO₂, SO₂, NO_x, (NO, NO₂), O₃, CFC, etc.

Classification - 2 :-

Based on property of the pollutant.

(i) Physical pollutant :- temp, turbidity.

(ii) Chemical pollutant :- Acids, bases, salts.

(iii) Biological pollutant :- micro organisms like virus, bacteria, fungi etc.

Classification - 3 :-

Based on their origin.

Primary pollutants:-

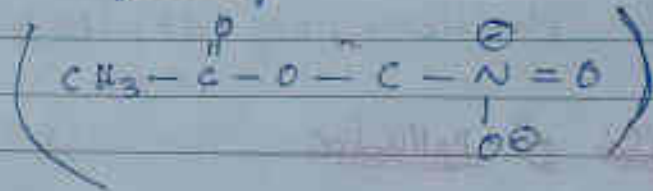
These substances which are emitted directly from the sources and remain in the environment in that form only.

ex- CO_2 , CH_4 , H_2S , PM , hydrocarbons, dust,

Smoke. SO_2 , NO , Carbon monoxide (CO) is the major primary pollutant.

(ii) Secondary pollutants:-

These substance are formed from primary pollutants, aldehydes, ketones PAN (Peroxyacetyl nitrate)

Classification - 3 :-

Based on health criteria.

Pollutants are classified into 2 categories by environmental protection Agency of USA:-

(i) criteria pollutants:- ozone (O_3), lead, carbon monoxide, NO_2 , SO_2 , particulate matter & volatile organic compounds.

(ii) qualitative pollutants:-

These substances do not normally occur in the environment but are introduced into it by human being. ex- insecticides, pesticides, acids, bases etc.

classification - 6:- Based on natural disposal.

(i) bio-degradable pollutants:-
substances which can be degraded or disposed of fully by the nature.
ex:- food.

(ii) non-biodegradable pollutants:-

Those substances which either don't fully degrade or take a long time to degrade in nature.

ex:- plastic, polyethalene, insecticides

Types of pollution

Air pollution:-

- (i) sources
- (ii) effect
- (iii) control.

Air pollution is the excessive addition of undesirable foreign substances into the atmosphere. Thereby adversely affecting the quality of air and causing damage to human, plants and animals.

Sources:-

There are 2 sources of air pollutant pollution:-

(i) Natural sources:-

→ volcanic eruptions - it emits P.M,
H₂S, CH₄ etc.

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- forest fires - it gives smoke, fume
unburnt hydrocarbon, CO, CO₂, NO_x, ash, etc.
 - oceans - it emits aerosols to the atmosphere.
 - Dust storms.
 - Lighting - it emits nitrogen oxide.

(ii) Man-made / Anthropogenic sources :-

- over pollution
- Deforestation.
- industrialization
- invention of automobiles
- electrical equipments
- invention of automobiles
- electrical equipments
- nuclear explosion
- explosives used during war.
- use of fertilizers.
- construction work.

Anthropogenic sources are of three types :-
(originating in human activities)

(a) point sources :-

They add pollutants to the air or atmosphere at particular points.
ex- exhaust pipes in automobiles
chimneys

(b) Line sources / Mobile sources :-

They add pollutants along a narrow belt over long distances.
ex- Automobiles (trucks, buses etc.)

Substance
aerosol is enclosed under pressure and released
as a fine spray by means of a
propellant gas

(c) Area Sources :-

They add pollutants over a large area. ex- industrial area.

Sources and effects of some air pollutants

1) Ozone :- Ozone is produced in stratosphere or in the troposphere (ground level ozone) from oxygen gas by absorption of UV light.



absorption is a chemical or physical phenomenon in which the molecules, atoms and ions of the substance getting absorbed.

Effects of ground level ozone (O_3)

(a) ozone gas destroys fabrics, soufflers, crops etc.

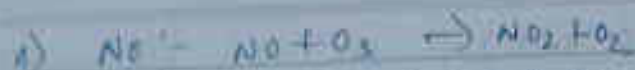
(b) it causes "necrosis" in plants.

"necrosis" is generation of dead areas in leaves.

(c) ozone is a greenhouse gas.

→ Depletion of ozone layer in stratosphere

It occurs due to depleting substances like CFCs (CF_2Cl_2), HCFCs (from Freon-12), Refrigerants, Halons, hydrocarbon radicals, NO.



Harmful effects

Due to depletion of ozone layer, the harmful UV rays enters into the troposphere.

The various ill-effects of UV rays.

- It causes eye-problems like cataract.
- It causes skin cancers.
- It causes swelling of skin.
- It causes ageing problem.
- visual impairment.
- Alteration of DNA.
- It decreases the moisture content of soil.
- It damages plants, fibers etc.

Control:-

- By awareness among people about its ill-effects.
- By using hydrochlorofluorocarbon instead of CFCs as refrigerant.
- By stopping the usage of fossil fuels.
(formed by natural process)

2) oxides of sulphur:-

- (a) Sources (SO₂):- volcanic eruptions (phalarope)
forest fire
Burning of fossil fuels.
natural sulphuric acid (petrol diesel)

- (b) Sources (SO₃):- oxidation of SO₂

ill effects:-

- (a) causes acid rain
- (b) causes chlorosis in plants.

chlorosis is the disappearance of chlorophyll from the leaves of plants which leads to yellowness of leaves.

- (c) causes many respiratory diseases like bronchitis.
- (d) causes eye-irritation
- (e) Damages crops, vegetation.

oxides of nitrogen (NO_x)

Sources:-

- (i) lightning - $N_2 + O_2 \xrightarrow{\text{lightning}} 2NO$
- (ii) Forest fire.
- (iii) explosive industries.
- (iv) Combustion of coal, petrol etc.

Harmful effects

- (a) causes difficulty in breathing.

cell phone emits - radio frequency radiation

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- (b) causes eye irritation
- (c) NO_2 cause premature falling of leaves. (abscission)
- (d) causes acid rain

4) HCl gas:-

→ Sources

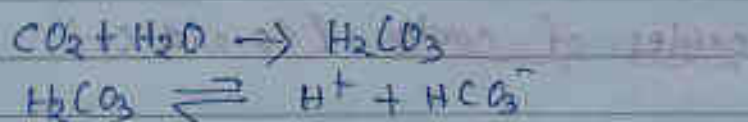
- (i) Pyrolysis of chlorinated organic materials.
- (ii) combustion of fuels.

ill effects :-

- (a) causes acid rain
- (b) causes many respiratory diseases.

sources and effects of acid rain

Normally rain water is slightly acidic (pH is 6) due to presence of carbonic acid (H_2CO_3)



when the pH of rain water drops below 5.6, it is called acid rain.

Industrial areas and thickly populated town or cities are acid rain-prone areas.

Acidic gases such as SO_2 , NO_2 , HCl, which were liberated by various processes like burning of fossil fuels, forest fires etc.

enters into the atmosphere where they undergo oxidation and react with water to form acids. (H_2SO_4 , HNO_3 , HCl) which falls slowly on earth as acid rain.

Chemical reaction



Harmful effects

- (i) causes corrosion of metals. ^{→ rusting}
- (ii) Damages monuments, building etc. ^(classical)
- (iii) Reduces soil productivity.
- (iv) contaminates drinking water.
- (v) It affects plants and animals life in aquatic ecosystem.

4) oxides of carbon (CO and CO_2)

Source of CO

- (i) incomplete combustion of fuels.
- (ii) Burning of leaves.
- (iii) Burning of incense sticks, mosquito coils.

ill effects of CO

- (i) It is very poisonous in nature because it binds strongly with haemoglobin to form carboxyhaemoglobin.

Carboxyhaemoglobin (CO-Hb) is nearly 200 times more stable oxyhaemoglobin (O-Hb). In blood when concentration of (CO-Hb) is 9% in blood, when concentration of CO-Hb reaches about 3-4%, the oxygen carrying capacity of blood is greatly reduced. This oxygen deficiency results in asphyxiation.

Sources of CO₂ :-

- (i) Industrial emission
- (ii) Burning of fuels
- (iii) Natural phenomenon such as forest fire, volcanic eruptions, etc.

Greenhouse Effects :-

About 51% of solar energy reaching the earth is absorbed by the earth's surface which increases its temperature. The rest of it radiates back to the atmosphere. However, some gases like CO₂, CH₄, CFCs, O₃, NO, H₂O vapour etc. in the troposphere act like glass in a greenhouse allows solar radiation to come in but strongly absorb the IR radiation (heat radiation) which earth sends back as heat. So, these gases trap heat energy and later radiate heat back into the earth's surface. Hence they cause global warming.

ex: CO₂, CH₄, N₂O

The effect of radiation of thermal energy back to the earth by those gases is called greenhouse effect (or global warming).

In fact, greenhouse effect keeps our planet warm and thus helps in sustaining life on the earth. The balanced/normal condition provides in the atmosphere.

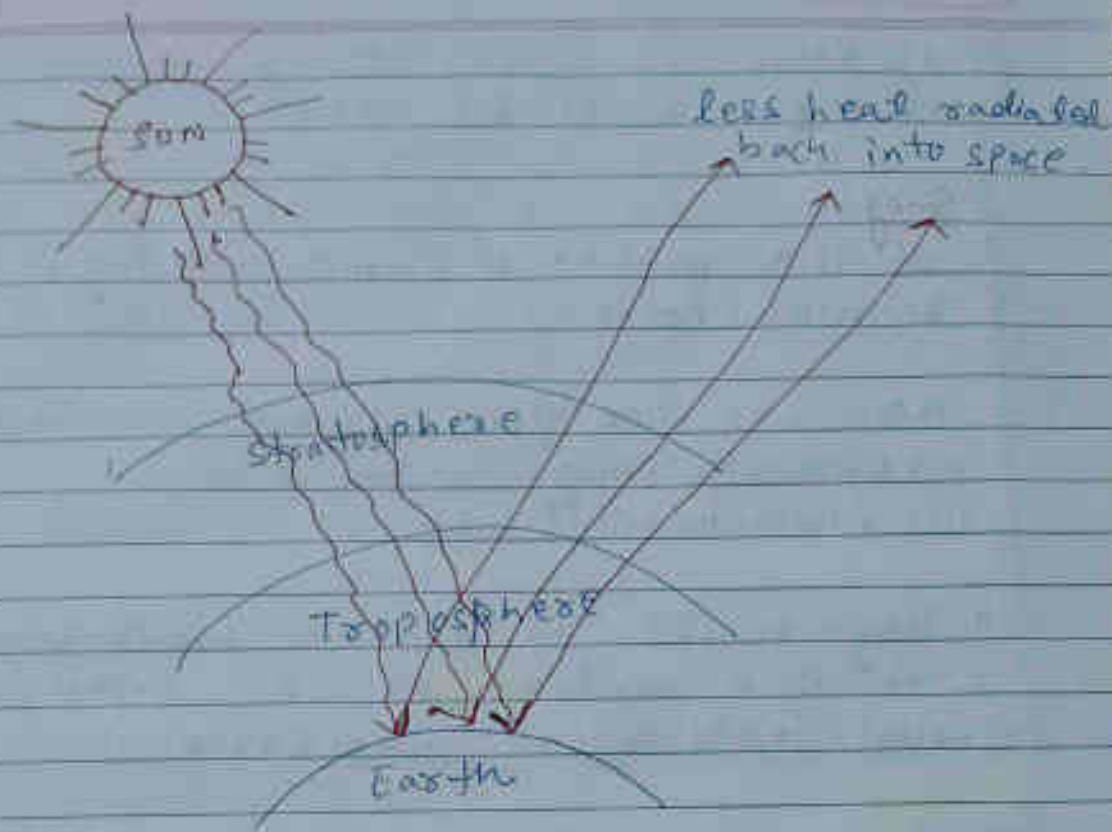
consequences:-

- (i) Surface water would evaporate faster than the thermal condition. It may lead to droughts. ^{relating to heat}
- (ii) Food productivity can be adversely affected due to alteration in the pattern of weather.
- (iii) May lead to melting of polar ice caps and flooding of low-lying areas.
- (iv) Due to warming of surface layers, biological productivity will decrease.

Control:-

- (i) By checking deforestation.
- (ii) By stopping burning of fossil fuels.
- (iii) Making people aware of the ill-effects.

Nitrous oxide (N_2O) \rightarrow Laughing gas



suspended particulate matters (SPM)

suspended particulate matter in the atmosphere can be classified into two categories:-

viable particulate matter is airborne

It includes minute living organisms like bacterial, virus, fungi etc. which are dispersed in the atmosphere.

Non-viable particulate matter:-

It includes smoke, dust, fumes, particles, smog etc. These non-viable particulates are classified as:-

- ii) $PM_{2.5}$ (size $< 2.5 \mu m$)
 iii) PM_{10} (size $2.5 - 10 \mu m$)

Smog:

It is a mixture of smoke and fog in suspended form.

There are two types of smog are found.

- i) classical smog
 ii) Photochemical smog

i) They occur in cool and humid atmosphere
 It is a mixture of SO_2 , smoke and fog. ex: London smog (1952).

ii) It occurs in dry and sunny climate
 It is obtained by the action of sunlight on mixture of hydrocarbons and NO usually obtained from automobiles and many industries.
 ex: Los Angeles smog.

Estimation of Photochemical Smog:

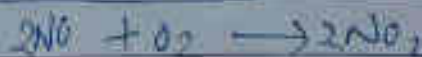
The various steps involved in formation of Photochemical smog are -
 (haze = smog, mist, fog)

Formation of NO :



Fossil fuel $\rightarrow H_2S + NO$

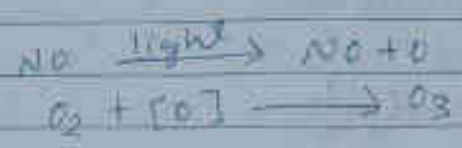
Formation of NO_2 :



Photochemical smog is a mixture of pollutants that are formed when nitrogen

oxides and volatile organic compounds react to sunlight creating a brown haze above cities. occurs in summer

formation of O₃



iii effects :-

- i) It damages plants.
- ii) It causes headache, chest pain.
- iii) dryness of throat.

control :-

- i) by warning people about its ill effects
- ii) by plantation (plants species like banyan)
- iii) by use of catalytic

control of air pollutant :-

- i) by use of equipments

Major component of photochemical smog :-

NO, O₃, oxidised hydrocarbons

iii effects.

- i) It irritates nose, eyes and lungs.
- ii) It causes headache, chestpain, dryness of throat.
- iii) It damages plants etc.

Control :-

- by spreading awareness among people about its ill-effects.

(iii) by plantation, especially plants species like pyrus & pirus.

Control of air pollutants:-

by use of equipments:-

These are 2 types of control equipments

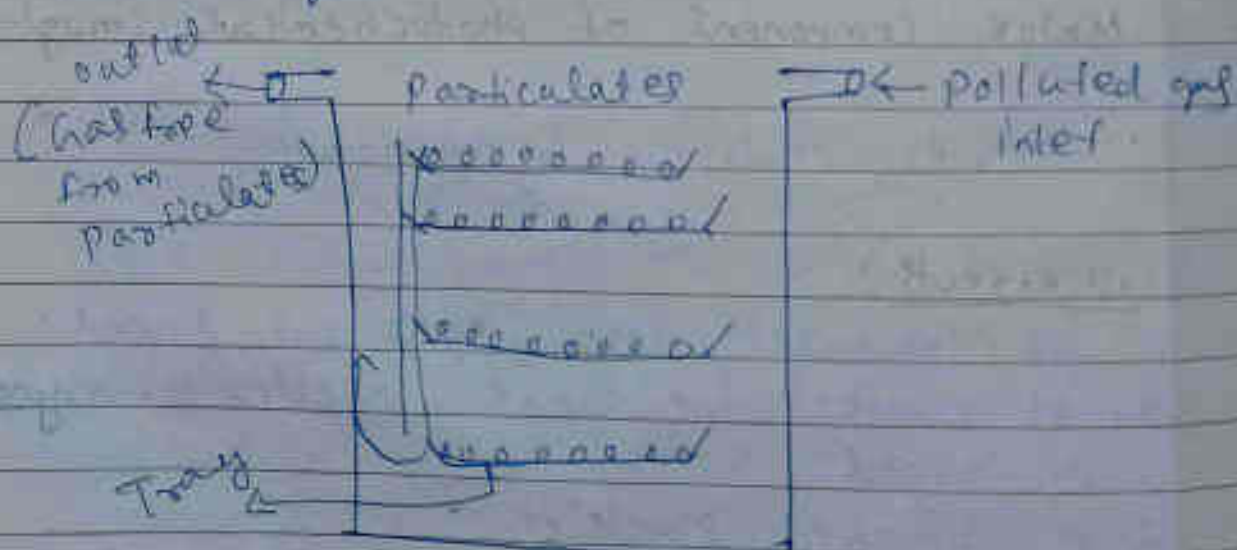
(a) equipments used for removal of gaseous pollutants

(b) equipment used for removal of particulate pollutants

Control devices for removal of particulate pollutants

Gravitational settling chamber:-

This control equipment is use to remove particles more than 50 μ m in size from polluted gas



The above control device consists of a huge rectangular chamber. The polluted gas stream is allowed to enter into it from one end. The horizontal velocity of the gas stream is kept low ($< 0.5 \text{ m/s}$) in order to give sufficient time for particles to settle under gravity in various trays from where they are removed time to time.

Advantages -

- (i) Pressure drop.
- (ii) Low initial cost.
- (iii) Low maintenance cost.
- (iv) Simple to construct.
- (v) Easy to design.

$$v_s = hv/L$$

L = length of chamber.

v = velocity.

v_s = settling velocity.

h = height through which

Disadvantages -

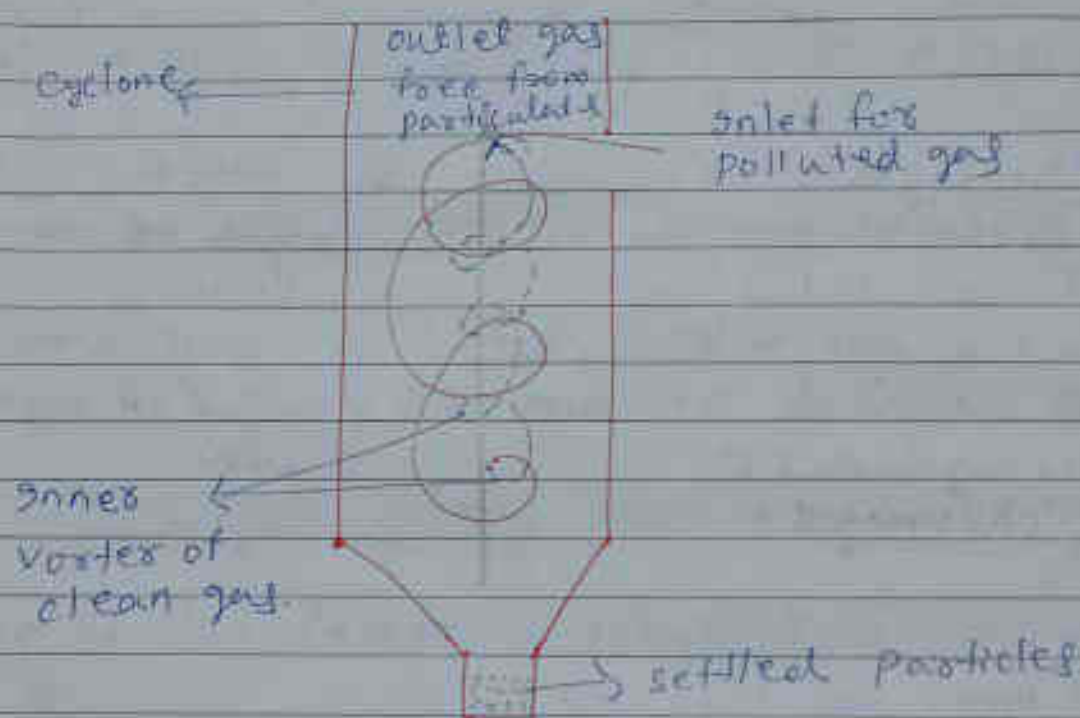
- (i) Fine particulates ($< 50 \mu\text{m}$) can't be removed from polluted air.
- (ii) Require large space.

Cyclone Separators -

It operates on the principle that particulates present in a stream of polluted gas possess a greater inertia than gas molecules.

On this method gas containing particulates is allowed to flow into a cyclone (a cylindrical chamber) so that air flows in a spiral pattern. The centrifugal force exerts great inertial effect on the dispersed particles, thereby forcing the particulates to move away from the gas and towards the wall of the cyclone.

From there, the polluting particles start settling under the effect of gravity. The particulate settling at the bottom of the cyclone are removed ~~for~~ periodically.



Advantages :-

- (i) Particles of size between 5 to 20 μm can be separated by this method.
- (ii) Low maintenance cost.
- (iii) Ability to operate at a high temp.

Limitation :-

- (i) unable to process sticky materials.
- (ii) equipment ~~to~~ is subjected to severe abrasion.
- (iii) very fine particulate matter of diameter 1 μm can be removed by this equipment.

Control of Gaseous Pollution:

1) Removal of oxides of sulphur (SO_2, SO_3)

(a) spray tower.

(b) alkaline alumina method.

It is an adsorption method.

In this method dust free polluted air is passed into a reactor where is the porous porous adsorbent (Na_2O, Al_2O_3) which adsorbs SO_2 gas at $25^\circ C$.

(c) adsorption by activated carbon/charcoal.

In this process the gas polluted gas is contacted with activated carbon in a reactor where carbon acts as catalyst for oxidation of SO_2 to SO_3 then SO_3 gas hydrolysis to H_2SO_4 on reacting with moisture.



2) Removal of nitrate oxide gas (NO_2, NO):-

The two widely used methods for removal of ~~nox~~ NO_x gas are:-

(a) Absorption Method:-

In this method NO_2 gas is passed into calcium hydroxide solⁿ so that NO gas will be removed as calcium nitrate and calcium nitrite.



(b) selective catalytic reduction method:-

(i) SCR using CH_4 as reduction agent.
in presence of $(\text{Pt Rh}/\text{V}_2\text{O}_5/\text{NO}_3) \rightarrow \text{catalyst}$



(ii) SCR using aq. NH_3



Water Pollution

①

Any change in physical, chemical and biological property of water by contamination with any unwanted substance which would ~~not~~ constitute water hazard by law using the quality of water and making it unfit for any use.

Sources

There are major two sources of water pollution

- (i) point sources
- (ii) non-point sources.

1) These sources whose location can be usually identified are called point sources.

ex- discharge pipes from industries as fumes etc.

2) These sources whose location cannot be usually identified are also called non-point sources.

ex- agricultural run-off, construction,

Types of water pollutant and these sources.

Types

(i) Micro organisms

(ii) Synthetic organic materials

(iii) Natural organic material

Sources

(i) Domestic wastes, man and animal ~~ex~~ feed.

(ii) pesticides, insecticides agricultural ~~used~~ acid.

(iii) Plant and human body parts.

(iv) Toxic usually metals (Pb, As, Cd, etc)	various acid
(v) phosphates and nitrates (plant nutrients)	fertilizer industries
(vi) oil	ship transportation, oil refineries
(vii) Heat	industries

water quality parameters:-

Hardness:- soluble calcium and magnesium salts.

pH:- acidic and alkaline changes.

Temperature:- 10°-15°C is treated as normal.

Taste and odour:- alkaline matter, phosphate nitrates etc are responsible for charging.

taste and odour odours naturally.

colour:- presence of iron salts, mg salts or Cu salts.

Pathogenous:- Microorganisms like bacteria, fungi etc.

turbidity:-

water quality standard:-

The various institution or agencies who plays important role in specifying the names for various water pollutants are

- 1) WHO
- 2) ISI - Indian Standard Institute.
- 3) ICMR - Indian Council of Medical Research.
- 4) USPHS - United States Public Health Service

According to ISI the recommended permissible limit for various water pollutants are listed below:-

Total dissolved solid :-	< 500 ppm.
Hardness :-	< 100 ppm.
Taste	Good.
Temperature	10-15°C
pH :-	6.5 - 8.0
DO (dissolved O ₂) :-	5 - 6 ppm.
COD (Chemical O ₂ demand)	10 (ppm)
Pb :-	< 0.1 ppm
As :-	< 0.05 ppm.
Hg :-	< 0.001 ppm
Cd :-	< 0.01
Cr :-	0.1 - 0.2 ppm

Effect of water pollutants:-

Suspended matter

effects

(1) Bacteria, Algae etc.

Stomach Disorders

(2) sediments - silica, clay

Turbidity.

Dissolved water pollutants

Effects

→ Ca and Mg salts

Hardness of water may lead to formation of stones in stomach
→ caustic soda, potash

→ Na_2CO_3 & NaHCO_3

Sodium carbonate - sodium

Hydrogen carbonate

Alkaline substances which lead to alkaline corrosion.

→ sulphate (SO_4^{2-})

Stomach upset.

→ fluoride

Fluorosis, skeletal & nervous disorders

→ Lead (Pb)

Anaemia, loss of appetite, blue lining between teeth and gum.

→ Mercury (Hg)

Paralysis, Brain disorders

→ Cadmium (Cd)

severe joint pain

→ Arsenic (As)

cramps, paralysis.

Hot water (T)

Decreases dissolved oxygen death of fishes.

control of water pollution :-

The various control measures are:-

(1) By reduction of pollutant concentration at the source:-

→ (catch).

(i) By trapping nutrients.

(ii) By aeration process (helps in dissolution in O_2)

(2) By reuse of water:-

Methods like activated sludge process and trickling filter can be used for treating municipal water.

(3) cooling of water:-

By minimizing thermal pollution, hot water should be cooled before being released from industrial.

(4) Use of suitable chemicals

ex: bleaching powder is added to kill pathogenic bacteriae like E. coli.

(5) Dilution of waste water before their discharge into any water bodies.

(6) Removal of pollutants like mercury, phenols, cyanides, phenolic compounds, sodium salts etc. can be done using special / advanced treatment processes like adsorption using carbon filter, ion-exchange process, electro dialysis, reverse osmosis etc.

(7) Bathing & washing of clothes in rivers, ponds etc. should be stopped.

(8) Sensible use of fertilisers and pesticides.

(9) Legislation:-

in 1974, "water pollution Act" was passed by the parliament to check water pollution.

in spite of legislative measures, ~~sew~~ severe penalties like life imprisonment and heavy fine for defaulters or those who are not obeying must be introduced and imposed.

(10) Public awareness

public awareness is the key to enunciate the dynamic change in attitude and make an effectual change in order to protect and preserve fresh water.

Treatment of surface water for domestic use (drinking)

Water collected from rivers, ponds, streams etc are called surface water.

Various steps involved in treatment of surface water for drinking purpose or any domestic use are:-

Removal of suspended matter

The suspended matter can be removed by the following methods:-

(a) Screening:-

Floating matters like leaves, twigs, plastic substances etc can be removed by passing through either a bar screen or netted screen.

(b) Sedimentation:-

It is a physical process by which suspended matters (size $> 150 \mu\text{m}$) can be settled down at the bottom of a sedimentation tank under the force of gravity.

In this method impure water is fed into a sedimentation tank and stands undisturbed for about 2 hours so that suspended matters can be deposited at the bottom under the action of gravity.

The clean water at the top can be drawn using pumps.

Coagulation:-

In this process, fine suspended matter can be removed from impure water by addition of chemicals like $FeSO_4 \cdot 6H_2O$, $NaAlO_2$, K_2SO_4 , $Na_2SO_4 \cdot 24H_2O$ known as ~~co~~ coagulations.

when ~~co~~ coagulant like potash alum is added to impure containing fine suspended matters and becomes heavy and settle at the bottom of the container later on due to force of gravity.

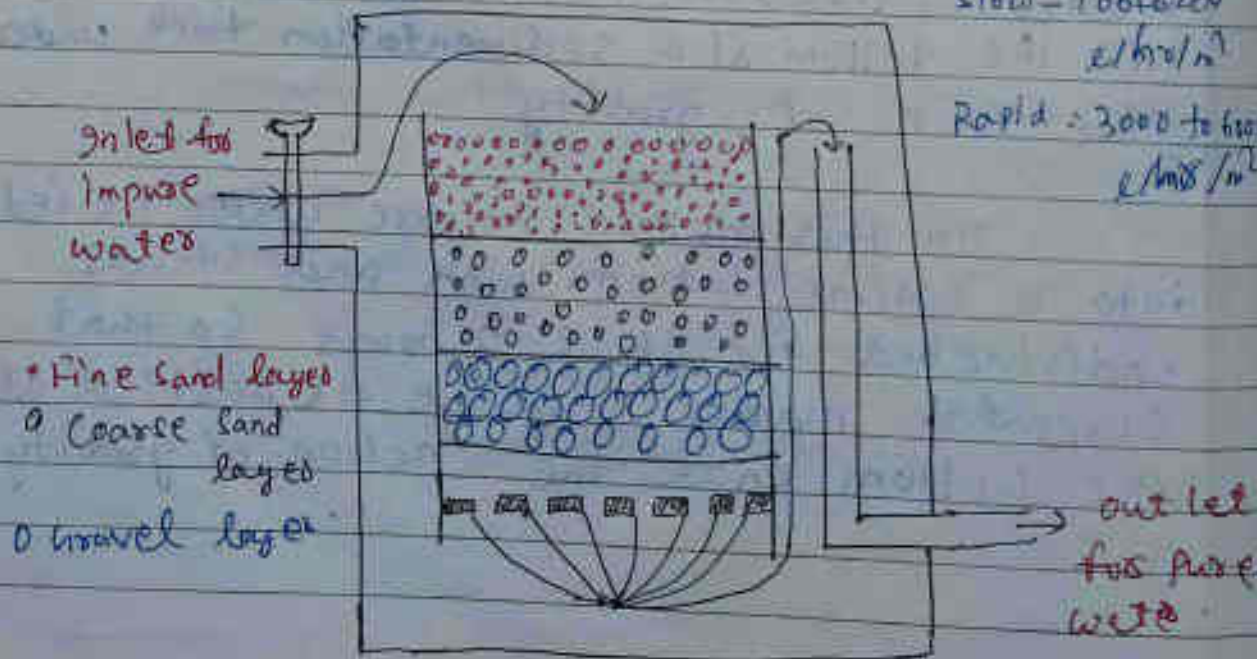
Filtration:-

On this process, colloidal / suspended matter, any micro-organisms, colouring substances etc. can be removed by passing impure water through a sand filter.

Rate of filtration

Slow - 100 to 200 $l/hr/m^2$

Rapid - 3000 to 6000 $l/hr/m^2$



- Fine sand layer
- Coarse sand layer
- Gravel layer

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Step-1 (Removal of Particulate matter)

A thick top layer of fine sand placed over a layer of coarse sand and gravels. It is provided with an inlet for impure water and under drain channel at the bottom for the exit of filtered water.

Step-2 (Removal of pathogenic bacteria or micro organism)

Micro organisms present in impure water can be removed or killed by addition of chemical substances like bleaching powder, chlorine tablet, chloramine (Cl-NH_2). These chemicals are known as disinfectants and the process is known as "disinfection".

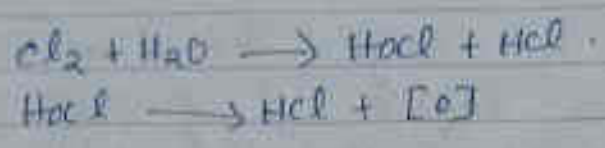
The killing of bacteria can also be done by passing of ozone gas, UV rays or by boiling.

The various disinfection processes are:-
(i) Boiling water for at least 10-15 mins.
(ii) Adding of bleaching powder

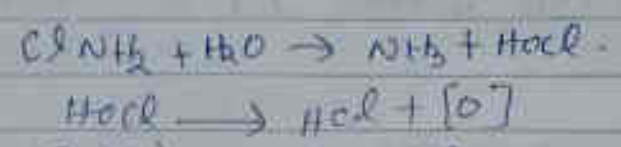


Both HOCl & [O] will germicidal.

(iii) Addition of chlorine tablet



(iv) By adding ClNH_2 (chloramine)



(v) By passing O_3 gas

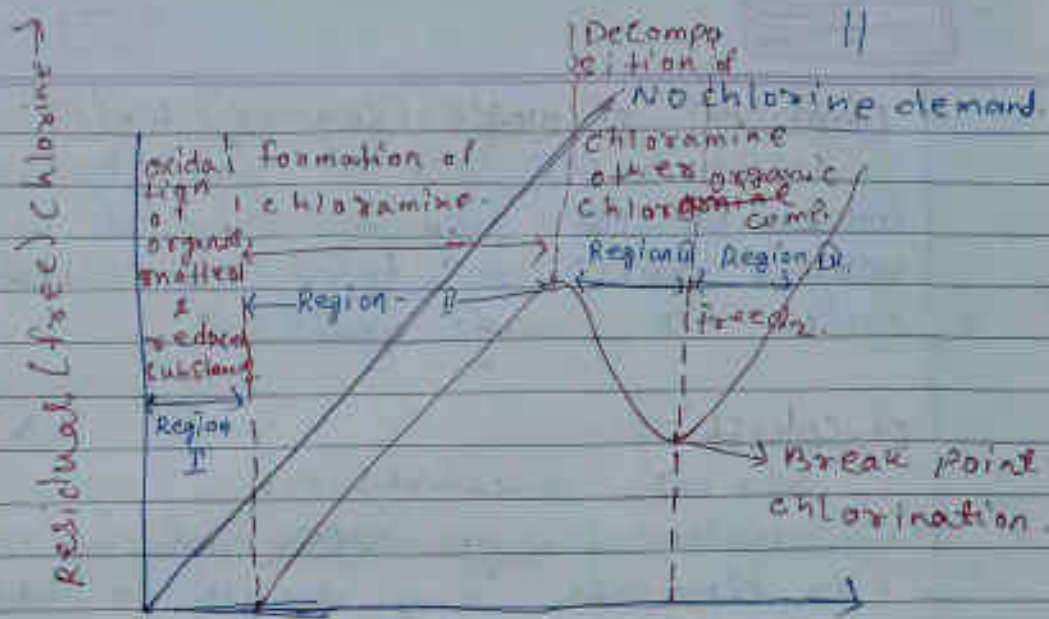


Break point chlorination:-

Q) what is break point chlorination? what is its significance?

It is a point in a plot or graph bet^{free}ween free chlorine against amount of chlorine added (mg/l) at which disinfection demand has been met successfully.

It involves addition of calculated amount of chlorine to the water in order to oxidise any organic matter present in it, oxidation of any reducing substances, conversion of free ammonia to chloramine etc and some free chlorine which is present after completion of all the aforementioned processes take place takes care of future contamination by bacteria so it also kills any bacteria present in it.



Amt. of Cl_2 added \rightarrow
 (Cl_2 dose (mg/L))
 residual of 0.2 mg/L is left after a contact period of 10 minutes.
significance

- (i) It helps in removing odour from water by liberating oxygen.
- (ii) It helps in removing any colouring substances present in water.
- (iii) It kills all the pathogenic bacteria (microorganisms) present in water.
- (iv) For field water. Supplies, army procedures require the provision of breakpoint chlorination in obtaining the minimum residual requirement of free available chlorine.

Treatment of waste (sewage) water:-

The water collected from households, industries etc. heavily loaded with various water pollutants is called waste water or sewage water.

Objectives:-

Various objectives are

- (i) To make sewage water inoffensive.
- (ii) To eliminate any danger to public health.
- (iii) To save aquatic animals etc.
- (iv) To make it suitable for other purposes like agricultural use as a coolant etc.

→ not objectionable or harmful.

The various steps involved in treating waste water are:-

① Preliminary Treatment stage

It involves screening of any floating matter present in waste water. Usually done by bar screen & netted screen.

② Primary treatment stage (Anaerobic)

In this stage, heavy suspended matter can be removed by sedimentation, fine suspended matter by coagulation, and then sedimentation, removal of bad odours causing substances, colouring substances removal of pathogens upto a certain extent by passing through a sand filter is done.

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Eutrophication - excessive richness of nutrients in a lake or other body of water, frequently due to run-off from the land, which causes a dense growth of plant life.

Secondary treatment stage (Aerobic)

This treatment is otherwise known as biological treatment process because it takes help of bacteria or microorganism present in waste water.

Objectives:-

- (i) To oxidise carbon based organic matter to carbon dioxide.
- (ii) To oxidise nitrogen based organic matter to ammonia and later to nitrogen.
- (iii) To remove plant nutrients. These are responsible for excessive growth of algae.

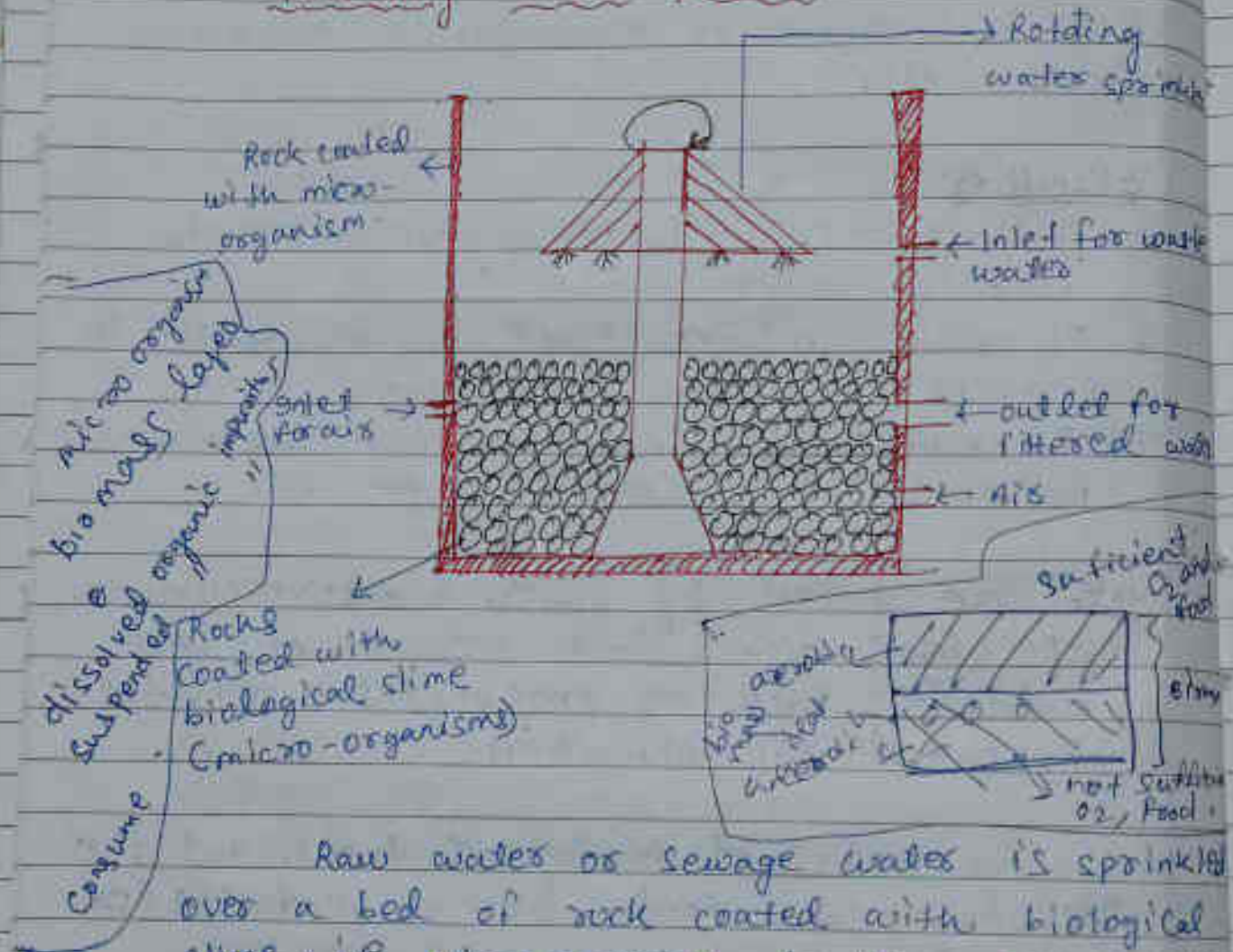
Note The process by which excessive growth of algae occurs due to presence of plant nutrients such as phosphates & nitrates is called eutrophication.

For efficient biological treatment the following conditions are to be fulfilled:-

- (i) Presence of large no. of micro-organisms to convert organic matter into CO_2 , NH_3 , N_2 etc.
- (ii) Presence of sufficient amount of oxygen.
- (iii) Some means or method is necessary to bring in contact micro-organisms & organic matter.

In general, the two widely used biological treatment processes are

Trickling Filter Process



Raw water or sewage water is sprinkled over a bed of rock coated with biological slime, i.e. microorganism. As the water trickles or percolates into the rock-packing, oxygen and dissolved organic matter diffused into the biological dissolved organic matter layer or biological film where as organic matter gets converted into low energy stabilised products like CO_2 .

The filtered water can be collected at the bottom of the trickling filter.

Activated Sludge Process

This process is based on the principle that adequate amount of oxygen/air is passed through the sewage water containing micro-organisms, so that complete aerobic oxidation can occur slowly. However, the oxidation process can be hastened if aeration is carried out in the presence of a part of sludge from the previous oxidation process. This added sludge from the previous oxidation process is known as activated sludge.

In general an activated sludge plant consists of the following three units:-

- (i) Aeration unit.
- (ii) A solid-liquid separation unit (settling chamber)
- (iii) A sludge recycle system.

Working Process

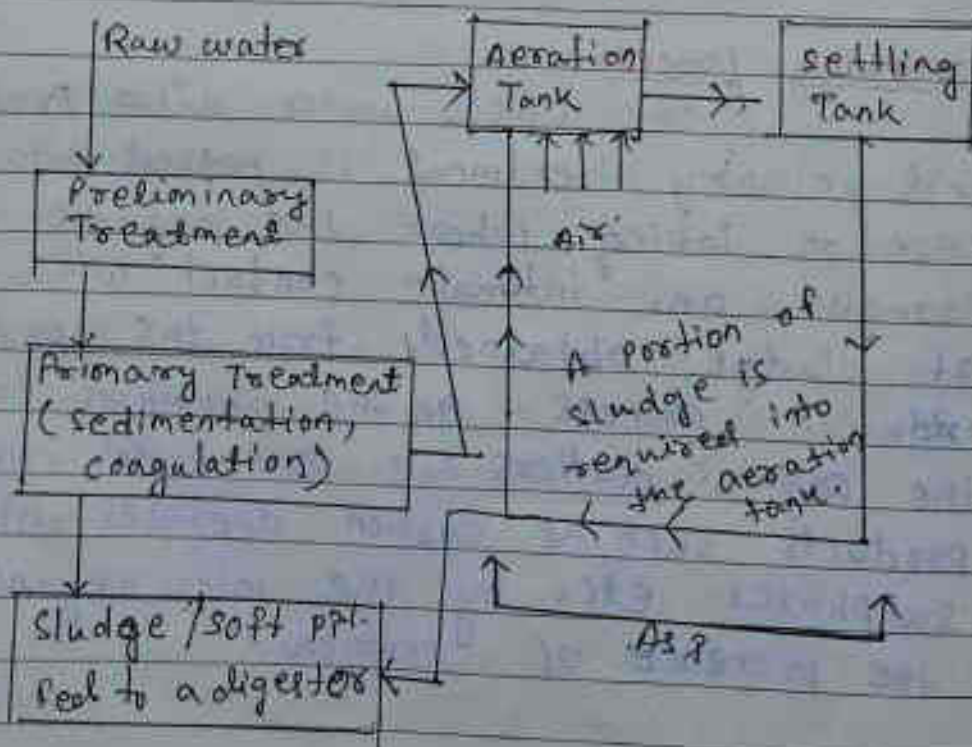
The waste water after preliminary and primary treatment is passed into a huge aeration tank where the organic matter is brought an intimate contact with a portion of sludge obtained from the previous oxidation process. In the aeration tank, the organic matters are converted into various products such as carbon dioxide, nitrates, sulphates etc. by the microorganisms in the presence of oxygen.

In the settling tank, the separated sludge exits without any contact with organic matter. Hence, they are in an active state of growth. Hence these sludge are known as activated sludge.

A portion of this activated sludge is recycled into the aeration tank and rest of the sludge is fed into a sludge digester. The water after this treatment can be used for any industrial or agricultural purpose as it is.

However, in order to get highly pure water this water has to be treated by adopting some advanced techniques such as reverse osmosis, electrodialysis, softening, softening process, adsorption etc.

Tertiary Treatment stage:-



waste water Quality Parameters -

BOD (Biological oxygen Demand)

It is a water quality Parameter. It is the amount of oxygen required by bio-decomposable organic matter present in waste water during a specific period (5 days) at a specified temperature of 20°C for the oxidation of those organic matters by micro-organisms.

This BOD can be represented by BOD₅ -

* BOD_u → oxygen demand by the organic matter determines after 21 days incubation period.
(ultimate BOD)

$BOD_u \approx 2BOD_5$ → BOD ultimate is assumed to be nearly twice of BOD₅

Determination of BOD

BOD can be determined by using Winkler's method.

A known volume of waste water sample is diluted with a known volume of dilution water. This water contains nutrients for bacterial growth but free from any organic matter.

After dilution, the whole solution is divided equally and taken in two separate bottles. The dissolved oxygen content of

bottle is determined immediately by Winkler's method. Another bottle is incubated in an incubation chamber for a period for a period of 5 days maintained at 20°C.

After incubation, the dissolved oxygen is determined. The difference in dissolved oxygen between the initial measurement and 5 days measurement multiplied with the dilution factor gives BOD.

Q. 10 ml of waste water is pipetted directly into a 300ml bottle containing some dilution water. The initial dissolved oxygen of diluted sample is 9 mg/L and its final dissolved oxygen after incubation of 5 days at 20°C is 2 mg/L. Then, find out the BOD.

Ans- $BOD = (DO_i - DO_f) \times \text{dilution factor}$

$$= (DO_i - DO_f) \times \frac{\text{final vol}}{\text{initial vol}}$$

$$= (9 - 2) \times \frac{300}{10}$$

$$= 210 \text{ mg/L or } 210 \text{ ppm}$$

<u>BOD (in ppm)</u>	<u>water quality</u>
1-2	very good.
3-5	moderately clean.
> 100	very polluted water.

PPM - parts per million.

Source	BOD (PPM)
Domestic Sewage	320
Paper mill	8150
Tannery	12,360

conclusion :-

- (i) it is a lengthy process.
 (ii) The BOD value is not full proof or precise or reliable.

COD (Chemical Oxygen Demand)

It is the amount of oxygen (O_2) required for oxidation of both biologically oxidisable & biologically inert matters by a strong oxidising agent like $KMnO_4$. In general, COD value is nearly 2.5 times the BOD value.

$$\text{COD} = \left[\left(\begin{array}{l} \text{Volume} \\ \text{FAS} \\ \text{used} \\ \text{for} \\ \text{blank} \\ \text{titration} \\ \text{(no waste} \\ \text{water)} \end{array} \right) - \left(\begin{array}{l} \text{Volume} \\ \text{FAS} \\ \text{for} \\ \text{waste} \\ \text{water} \\ \text{sample} \end{array} \right) \right] \times \left[\begin{array}{l} \text{Strength} \\ \text{FAS} \\ \times 8 \end{array} \right] \times 1000$$

mg/l.

vol. of sample taken for titration

- * inert is used to describe a substance that is not chemically reactive.
 Note gases were previously known as inert gases.

Determination of COD :-

A known volume of waste water sample is refluxed ^{oxidised} with known vol. of excess $K_2Cr_2O_7$ in presence of sulphuric acid, Silver Sulphate, $HgSO_4$. The unreacted $K_2Cr_2O_7$ is then titrated against a standard Mohr Salt solution (FAS - Ferrous ammonium sulphate) to determine the amount of O_2 used for oxidising organic matters.

Potassium
dichromate
indicator

A blank titration is performed between distilled water + $K_2Cr_2O_7$ against ferrous ammonium sulphate solution under similar condition the test sample. Now the difference in volume of ferrous ammonium sulphate required in blank titration and for test sample is to be required.

Let the difference be n ml. we know that

$$1000 \text{ ml of } 1 \text{ N FAS} = 8 \text{ gm of } O_2$$

$$1 \text{ ml of } 1 \text{ N FAS} = \frac{8}{1000} \text{ gm} = 8 \text{ mg of oxygen}$$

$$1 \text{ ml of } 0.1 \text{ N FAS} = \frac{8}{1000} \text{ gm} \times 0.1$$

$$= 8 \times 0.1 \text{ mg of oxygen}$$

$$n \text{ ml of } 0.1 \text{ N FAS} = 8 \times 0.1 \times n \text{ mg of oxygen}$$

Let 25 ml of raw water required:

$$(8 \times 0.1 \times n) \text{ mg of } O_2$$

10.00 ml of Raw water required = $\frac{8 \times 0.1 \times N}{25} \times 1000$

$$\frac{8 \times 0.1 \times N}{25} \times 1000$$

$$= \cancel{800} \frac{0.8 N}{25} \times 40$$

$$= 32 N \text{ mg/lit}$$

$$\text{COD (mg/lit)} = \frac{\left(V_{\text{FAS (blank)}} - V_{\text{FAS (first)}} \right) \times S_{\text{FAS}} \times 8}{\text{Vol. of Sample taken for titration}} \times 1000$$

Numerical :-

- a. 2.7 ml of waste water that was refluxed with 10 ml of 0.25 N $\text{K}_2\text{Cr}_2\text{O}_7$ sequence. 6.5 ml of 0.1 N FAS. A blank titration was performed by taking 25 ml of distilled water and 10 ml of 0.25 $\text{K}_2\text{Cr}_2\text{O}_7$ which required 25 ml of 0.1 N FAS. Find out COD value?

$$\text{COD} \cdot V_{\text{FAS (blank)}} = 2.7 \text{ ml}.$$

$$V_{\text{FAS (first)}} = 6.5 \text{ ml}.$$

$$S_{\text{FAS}} = 0.1 \text{ N FAS}.$$

$$\text{Vol. of Sample taken for titration} = 25 \text{ ml}.$$

$$\text{COD} = \frac{\left(V_{\text{FAS (Blank)}} - V_{\text{FAS (Dist)}} \right) \times N_{\text{FAS}} \times 8}{\text{Volume of Sample taken for titration}} \times 1000$$

$$= \frac{(2.7 - 6.5) \times 0.1 \times 8}{25} \times 1000$$

$$= 65.8 \text{ mg/lit as ppm.}$$

SOIL POLLUTIONS

The top most layer of land is called soil. It consist of 4 major contribution constituents:-

1) It is the contamination of soil by harmful substance which can degrade the quality of soil and health of those living on it.

→ The various soil pollutants are:

lead, ~~atom~~ arsenic, cadmium (toxic metal) acids and base, synthetic ~~or~~ organic solvent, fertiliser, pesticides.

Sources of soil pollution:-

1) Industrial activities:-

It includes mining industries, fertiliser industries, etc.

2) Agricultural activities:-

used for pesticides, insecticides etc.

3) Improper waste disposal.

4) acid rain

5) Accidental oils spill.

6) soil erosion due to deforestation or excessive grazing of animals.

7) Developmental activities like construction of roads, bridges, houses etc.

8) radioactive waste materials discharged from research laboratory and hospitals.

9) polluted water.

Effects of soil pollution:-

- 1) decreases the fertility of soil.
- 2) it affects the growth of plants and reduces production capability.
- 3) it ~~is~~ affects on human health.

Control of soil ~~soil~~ pollution

- 1) by adopting organic modes of farming.
- 2) by banning of plastics or any non-biodegradable materials.
- 3) by banning use of toxic chemicals.
- 4) by public awareness.
- 5) by adopting 3 R's rule (Recycle, Reduce, Reuse).
- 6) by afforestation.
- 7) by proper dumping of unwanted waste materials.

NOISE POLLUTION

Any unpleasant or unwanted sound is known as noise. Any sound which pleases a listener is music and that which gives any pain or irritation is noise.

Noise pollution is the excessive sound level which is harmful to human and animals health.

unit of sound - it is expressed in decibel (dB)

Decibel:-

It is expressed as logarithmic ratio of sound signal like power, sound intensity, pressure etc.

Sound Power Level:- (dB)

$$\text{SPL} = 10 \log_{10} \left[\frac{P_{\text{measured}}}{P_{\text{ref}}} \right] \quad P_{\text{ref}} = 10^{-12} \text{ W}$$

where, $P_{\text{measured}} = 10^{-12} \text{ W}$, then $\text{SPL} = 0 \text{ dB}$

$P_{\text{measured}} = 10^2 \text{ W}$, then $\text{SPL} = 170 \text{ dB}$

Sound Intensity Level:-

$$\text{SIL} = 10 \log_{10} \left[\frac{I_{\text{measured}}}{I_{\text{ref}}} \right] \quad I_{\text{ref}} = 2 \times 10^{-12} \text{ W/m}^2$$

Sound Pressure Level:-

$$\text{SPL} = 10 \log_{10} \left[\frac{P_{\text{measured}}}{P_{\text{ref}}} \right]^2 = 20 \log_{10} \left[\frac{P_{\text{measured}}}{P_{\text{ref}}} \right]$$

$$P_{\text{ref}} = 2 \times 10^{-5} \text{ Pa}$$

Sources of Noise Pollution:-

- ① Industrial activities- ~~Textile~~ Textile ind., fabrication, mining, workshop etc.
- ② Household- It includes indoor noise
- ③ Agricultural farm equipments- It includes tractors, harvesters etc.
- ④ Transport vehicles- aeroplanes, trains.
- ⑤ Development activities- construction works.

Effect of noise pollution:-

Noise pollution has many physical, psychological, ~~physiological~~ ^{physiological}, physiological effects.

Physical:-

It includes damage to cars and temporary or permanent hearing loss.

Physiological:-

It includes muscular strength, headache, eye strain, waist pain etc.

Psychological:-

It includes irritability, ~~stress~~

control of noise pollution:-

1) control at receiver end:-

by use of personal protective protective equipments like ear plugs, noise helmets etc.

2) control of suppression of noise at source:-

This can be achieved by following methods by suitable designing and fabrication of noisy machines.

3) Proper lubrication and maintenance of equipments.

4) Installing noisy machines in sound proof chambers.

5) by covering noisy machines by sound absorbing materials.

6) Planting of trees.

7) Sound insulation at construction stages.

This can be done by using sound proof ~~tile~~ tile made out of essential materials like glass fiber wools, Poly urethane f

8) Legislative measures

Section 2(a) of air (prevention and control) pollution act (1986) includes ~~the~~ noise in the definition of air pollution.

Noise pollution Rule (2002) lay down terms and conditions necessary to reduce noise pollution, permit use of loud speakers during night hours.

Acoustic zoning :-

It means that increasing the distance between source and receiver by zoning of noisy industrial areas, aerodrome, radiostations terminals etc away from residential areas.

Solid waste is

Solid waste

Solid wastes constitutes the highly heterogeneous mass of discarded materials from urban community agricultural and industrial activities.

Sources of Solid wastes:-

Municipalities:-

These waste materials includes vegetable, vegetables, fruits skin peels, spoiled food items, cardboard, aluminium- cans etc.

Agricultural activities:-

waste materials includes crop residues, animal waste etc.

Industrial activities:-

It includes fly ash, oil and mineral processing waste, chemicals, paints, metal etc.

Hospital and Research Institutions:-

It includes radioactive materials, toxic chemicals, biological waste materials.

Developmental activities:-

stone, bricks, concrete, metals, polymers etc.

Classification of solid waste -

- 1) Municipality waste
- 2) Industrial waste.
- 3) Agricultural waste.
- 4) Demolition and construction waste.

In general solid waste are broadly classified into two categories:-

- (i) Non-hazardous waste.
- (ii) Hazardous waste.

Properties of solid waste

Physical Properties:-

These properties are useful in waste management.

Density:- as it is useful for volume calculation. It is important in storage, transport and land disposal.

Moisture content:- It is important when solid waste is used for heating purpose.

Particle size and their distribution:-

It is useful during recovery of materials by mechanical means.
ex:- screening.

Field capacity

The total amount of moisture that can be retained in a solid waste subjected to downward pull of gravity.

Control measures

Noise pollution

Meaning

- A loud, unpleasant, unwanted sound = noise
- Sound is measured in decibels (dB)
- A decibel value above 80 is considered to be noise pollution

Effects

Auditory effects

- Deafness or impaired hearing (temporary or permanent)
- Auditory fatigue (temporary loss of hearing after exposure to sound)

Non auditory effects

- work efficiency
- Irritation and annoyance
- Trouble in communication

dB - A
dB - C
dB - Z
dB - F
dB - G
dB - H
dB - K
dB - L
dB - M
dB - N
dB - P
dB - R
dB - S
dB - T
dB - V
dB - W
dB - X
dB - Y
dB - Z
dB - AA
dB - AB
dB - AC
dB - AD
dB - AE
dB - AF
dB - AG
dB - AH
dB - AI
dB - AJ
dB - AK
dB - AL
dB - AM
dB - AN
dB - AO
dB - AP
dB - AQ
dB - AR
dB - AS
dB - AT
dB - AU
dB - AV
dB - AW
dB - AX
dB - AY
dB - AZ

dB - A
dB - C
dB - Z
dB - F
dB - G
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dB - K
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dB - M
dB - N
dB - P
dB - R
dB - S
dB - T
dB - V
dB - W
dB - X
dB - Y
dB - Z
dB - AA
dB - AB
dB - AC
dB - AD
dB - AE
dB - AF
dB - AG
dB - AH
dB - AI
dB - AJ
dB - AK
dB - AL
dB - AM
dB - AN
dB - AO
dB - AP
dB - AQ
dB - AR
dB - AS
dB - AT
dB - AU
dB - AV
dB - AW
dB - AX
dB - AY
dB - AZ

Noise pollution causes

- fire smoke
- industrialization (big masonry generators, exit fans)
- fire works (Debale)
- defence equipment and launching of satellites
- social events (Place of worship, marriage, Poojas)
- Transportation (Trains, Aeroplane, Car)
- passage of time

Control measures

- planting of trees
- Acoustic zoning (distance between source and receiver) Residential, Education, Hospital
- Legislative measures (Police, Law)
- Control at receiver end (ear protection, earplugs, headphones)
- precaution is better than cure (sound insulation at construction stage)
- Choose the insulation

It is important in determining in formation of Leachate in land fields.

Permeability

It governs the movement of liquid and gases in a land fields. It basically depends on surface area.

Chemical properties

They are useful in evaluating the alternative processing and recovery options. Some useful characterization techniques are:-

Proximate Analysis

It includes calculation of moisture content, % of volatile matter content, % of ash content, % of fixed carbon content.

% of fixed carbon content =

$$(100 - \% \text{ moisture} + \text{volatile matter} + \text{ash})$$

Ultimate Analysis

It includes determination of % of C, % of N₂, % of S₂, % of S₂ acid, % of O₂, and % of ash.

Fusion point of Ash

It is the temperature at which the ash resulting from burning farm solid wastes form a solid mass called "clike" by fusion and aggration.

Energy Content of solid waste:-

heat content.

Biological properties:-

It reveals whether the solid waste is biodegradable or not.

Management of solid waste:-

- 1) Management of non-hazardous solid wastes. (Municipality solid wastes)
- 2) Management of hazardous solid wastes.

It is a comprehensive waste prevention and reduction, reuse, recycling, reusing and disposal program.

Objective:-

- 1) To minimize the adverse effects on human health and environment.

A solid waste management program involves the following steps:-

- (a) source reduction and waste prevention.
- (b) waste utilization.
- (c) waste disposal.

hazardous waste

- To understand the definition of hazardous waste and its sources of generation.
- To gain knowledge on the classification of hazardous waste.
- familiarize the collection methods involved.
- To understand the methods of segregation used.

Hazardous waste

The solid materials or combination of solid materials that can cause harm to human beings, animals and plants.

Sources

- (i) Hospital and research institutions
- (ii) Petroleum refineries.
- (iii) Paint industries, mining industries.
- (iv) chemical industries.

Characteristics:-

A substance is said to be hazardous if it passes as more of the following characteristics:-

Toxicity:-

It includes Hg, lead (Pb), As, DDT etc.

Reactivity:-

A substance is said to be reactive when it has a tendency to react vigorously with air and water, all unstable to heat or shock or pressure, generated toxic gases etc.

Solid waste management

waste - It is defined as any material that is not useful and does not represent any economic value to its owner, the owner being the waste generator.

Classification of waste

Depending on the physical state of waste, wastes are categorized into solid, liquid and gaseous. Solid wastes are categorized into municipal wastes, hazardous wastes, medical wastes and radioactive waste.

Municipal solid waste (MSW)

It is defined as any waste generated by household, commercial and/or institutional activities and is not hazardous.

Classification of solid waste

- ① Based on its origin: domestic, industrial, commercial, construction or institutional.
- ② Based on its contents: organic material, glass, metal, plastic, paper.
- ③ Based on its hazard potential: toxic, non-toxic, flammable, radioactive, infectious.

organic waste and inorganic waste

organic waste is also called as biodegradable waste, organic waste can be disintegrated by ~~micro~~ organic microorganisms and other living beings into methane, water, carbon dioxide and other living ~~organisms~~ organisms using composting or aerobic representation anaerobic respiration, leaven fermentation and other similar processes. The inorganic waste is composed of material other than plant and animal matter such as synthetics, dust, ~~and~~ sand and glass.

e-waste

Electronic waste is defined as electronic products that have turned into non essential, redundant, non operational, obsolete and attained end of their useful life.

Solid waste and pollution

Solid waste causes pollution to environment in following ways -

- ① untreated solid waste emits greenhouse gases
- ② when burnt/unburnt solid waste emit toxic fumes and particulate matters.
- ③ when left unsegregated and disposed safely they accumulated in open landfills -
- ④ They contaminate ground water by leaching of chemical and organic compositions -
- ⑤ They pollute water bodies by rain water/flood water runoff when disposed ^{carelessly}

Treatment and disposal of solid waste

- ① open dumps → flies → disease → rain
- ② Landfills
- ③ Sanitary landfills -
- ④ incineration plants.
- ⑤ pyrolysis → combustion → absence of O_2
- ⑥ Composting → presence of O_2
- ⑦ Vermiculture.
- ⑧ Bioremediation -
- ⑨ phytoremediation -
- ⑩ Micro remediation → fungus
- ⑪ mycofiltration.

→ plants ka use kiya jata hai basically soil or water main se contaminant nikalne ke liye.

⑫ ~~phyto~~ extraction.

Disaster management

Type of disaster

① Natural disaster

- Flood
- Earthquake
- Volcanic eruption
- cyclone
- Land slide etc

② Environmental emergencies

- Bhopal gas leak disaster (1984)

③ Complex emergencies

- Looting attack
- Terrorist activities and war

④ Pandemic emergencies

- Sudden effect of contagious disease as ~~corona~~ COVID-19, plague, chicken pox etc.

Types of natural disaster

① Geophysical

- Earthquake
- volcano
- Landslide (Dry)
- Rock fall (Dry)

② Biological

- ① Epidemic
- ② infectious diseases

③ insect bites

③ meteo logical

- > Local storm.
- > Tropical and Extratropical cyclones.

Hydrological

- ① Tsunami
- ② flood.
- ③ Land slide (wet)
- ④ Rock fall (wet)

climatological

- Hot
- ① Heat wave
 - ② Cold wave.
 - ③ Drought.
 - ④ forest fire.

Types of Disaster

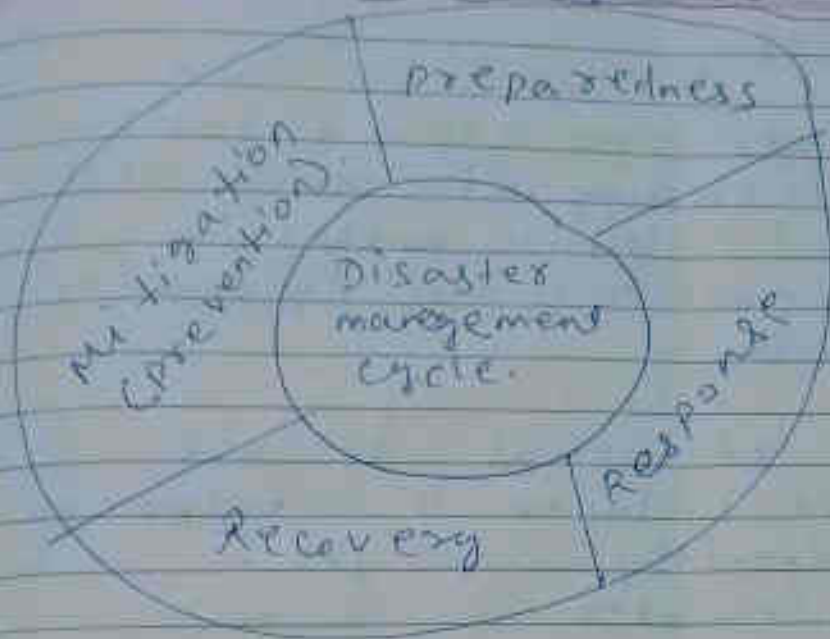
Natural

- ① Flood
- ② earthquake
- ③ cyclone.
- ④ volcanic eruption.
- ⑤ epidemic.
- ⑥ Tsunami

man made

- ① Air crash.
- ② ship sinking
- ③ Train accident
- ④ Building collapse.
- ⑤ Bridge collapse
- ⑥ Bomb blasts.
- ⑦ warfare.

Disaster management cycle



Flood and their types

Flood caused by heavy rainfall, snow melts, severe winds over water, unusual high tides, flood associated with high water in rivers, streams, mountain streams, canals, lakes.

Flood associated with flooding an area with water coming directly from rain or melting snow.

may include urban storm water or high water in non urban.

Types of flood

- ① flash flood
- ② coastal flood.
- ③ fluvial flood.
- ④ urban flood
- ⑤ Pluvial flood

Earthquake

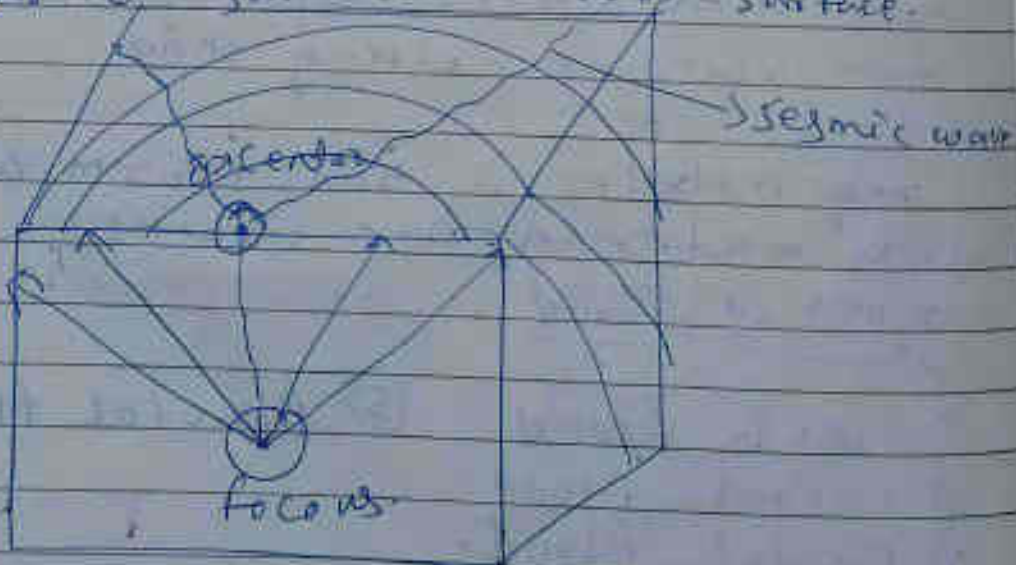
An earthquake is the result of sudden release of energy in the earth crust that creates seismic waves.

An earthquake is caused by sudden slip on fault.

The place of initial rupture of earthquake is called by hypocenter and ground directly above the hypocenter is called epicenter.

Classification of earthquake (speed)

- ① intensity (two scale used to measure intensity mmi and msu)
- ② magnitude (for measuring the magnitude use Richter scale)
- ③ Epicenter - It is the point where earthquake originates, it is directly above the focus on the earth surface.



National guideline on earthquake risk management in India

- ① ensure the incorporation of earth resistant design features for the construction of new structure.
- ② facilitate selective strengthening and seismic retrofitting of existing and lifeline structure in earthquake prone areas.
- ③ introduce appropriate capacity development interventions for effective earthquake management (including education training, R&D and ~~data~~ documentation).
- ④ improve awareness and preparedness of all stakeholders.
- ⑤ strengthen the emergency response capacity in earthquake prone areas.

incorporate now - take in or contain whole as part of a

Cyclone

In meteorology a cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure.

Cyclones are characterized by inward spiraling winds that rotate about a zone of low pressure.

Cyclone is a whirl in the atmosphere with very strong winds circulating around it in anticlockwise direction in the northern hemisphere and clockwise in southern hemisphere.

The term tropical cyclone is used in the Indian ocean, Bay of Bengal and Australia waters with wind speed of 118 km per hour .

HURRICANE - same storms called hurricanes in the Caribbean, Gulf of Mexico, Atlantic ocean etc.

TYPHOON - North west Pacific in the vicinity of Philippines and Japan, the same storms known as typhoon.

Landslides

Landslide is a geological phenomenon caused by the mass movement of rock, earth or debris down a slope, whereas a broad range of motions like falling, sliding and flowing under the influence of the gravity take place.

Landslides are caused by rain, earthquake, volcanoes or other factors that make the slope unstable.

The two regions most vulnerable to landslides are the Himalayas and the western Ghats.

Main causes of landslides are

- ① Geological causes.
- ② Morphological causes. (A particular form ^{shape of} land)
- ③ Anthropogenic causes. (Originating ^{from} ~~land~~ ^{human} activities)
- ④ ~~man~~ physical causes (Int human activities)
- ⑤ Man made caused.

Nuclear accidents and hole causes

The nuclear plants which control the chain reaction to release energy steadily have their own demerits. They cause thermal pollution - the waste heat from the plants heats up the environment and release highly dangerous radiations into the environment.

National Disaster Management Authority

On 23rd December 2005, the Government of India enacted the Disaster Management Act, which envisaged the creation of National Disaster Management Authority (NDMA).

The National Disaster Management Authority (NDMA), headed by the Prime Minister of India, is the apex body of disaster management in India.

India envisions the development of an ethos of prevention, mitigation and preparedness.

General effects of Disasters.

- ① Loss of life
- ② Injury
- ③ Damage to and Destruction of Property.
- ④ Damage to and destruction of production.
- ⑤ Disruption of Lifestyle.
- ⑥ Loss of livelihood
- ⑦ Disruption of essential services.
- ⑧ Damage to national infrastructure.
- ⑨ Disruption to governmental systems.
- ⑩ National economic loss.
- ⑪ Sociological and physical after effects.

effects of natural disasters.

unit-6

Social Issues

- Any problem which affects a group of people or area which needs to check out.
- It is often consequence of factors extending beyond an individual control.
- Disagreement between individuals of groups can leads to social issues also called interaction perspective.

various social issues

- ① Racial discrimination [Black & white]
- ② caste discrimination [Low caste & high]
- ③ poverty [Bhukhari]
- ④ Drug abuse [Nasa]
- ⑤ political corruption []
- ⑥ unemployment
- ⑦ sexual abuse [females, male]

(8) Illiteracy (education & health)

(9) Bullying [child abuse]

(10) Migration

(11) Gender discrimination

(12) Social inequality (Income, discrimination)

(13) Regionalism

(14) Religious conflicts.

Environmental Issues

various environmental problems that world facing today are

(1) Ozone Depletion, Green House effect & global warming.

(2) Desertification.

(3) Deforestation.

(4) Loss of biodiversity.

(5) Disposal of waste.

(6) Water scarcity & water pollution.

② over population

③ waste disposal

④ pollution

⑩ Land management

Sustainable Development & Lifestyle

→ sustainable development is that which meets the need of present generation without compromising the needs of future generation.

→ its aim is to balance our environmental, social & economic, allowing prosperity for present and future generations.

→ is organising principle for meeting human development goals and simultaneously sustaining the ability of environment to provide natural resources & ecosystem services on which society depends.

→ Three pillars of sustainability are economy, society & environment.

Advantages of sustainable development

- sustainability maintains health & bio-capacity of environment.
- sustainability supports the wellbeing of communities
- sustainability promotes better economy, little waste & pollution & better economy, little waste & pollution & better distribution of wealth.
- ~~sustainable~~ sustainable development can be achieved by using recycled material and renewable resources of energy.

sustainable development goals (SDGs)

17 goals designed for better present and more sustainable future.

- ① No poverty.
- ② Zero Hunger
- ③ Good Health.
- ④ Quality education.
- ⑤ Gender equality.

- ⑥ clean water sanitation.
- ⑦ Affordable & clean energy.
- ⑧ Industry, Innovations & Infra. Structure.
- ⑨ Reducing Inequality.
- ⑩ Decent work & Economic Growth.
- ⑪ Sustainable cities & communities.
- ⑫ Responsible consumption & production.
- ⑬ climate action.
- ⑭ Life Below water.
- ⑮ Life on Land.
- ⑯ Justice & peace Justice strong institutions.
- ⑰ Partnership to achieve the goals.

challenges to sustainable development

→ Are global in character includes poverty & exclusion, unemployment, conflict & humanitarian aid, climate change, building strong institutions for governance and

maintaining law & order:

→ uncontrolled development leads damage to environment in terms of release of toxic & hazardous waste.

② URBAN Energy Problem

→ urban areas having high density population which demands large volumes of energy for normal day to day activities. In form of electricity, fuel, gas etc.

→ URBAN energy is required for every thing to provide cities citizens with water, water treatment, heating, cooling, other community functions, powering houses, traffic, communication, disposal of waste, transportation, infrastructure development & industrial consumption.

→ mainly energy consumed by urban population is obtained from combustion of fossil fuels which leads to air pollution and loss of reservoirs of fossil fuels due which is not a sustainable practice.

→ urban energy problem can be sustainable by using renewable sources of

energy as like wind, solar, hydro power stations, use of urban waste for electricity production and by educating citizens to save energy.

① Resettlement & Rehabilitation

→ major projects for public welfare like dams, expressways, railway track formation, mines, national parks require large area. During acquisition of land life of people who lives in that area is disrupted also large problem occurs are site of their rehabilitation. Our country is over populated country high quality land available. Thus most of people given waste land.

→ Resettlement puts pressure on project affected people and people who have living previously in that area. Thus both communities suffers and conflict over resources occurs.

④ ENVIRONMENTAL ETHICS

→ environmental ethics deals with the fundamental rights of individual animals ^{and} future generation also.

→ for life and wellbeing environment ethics deals with issue how we utilise and distribute resources uniformly in urban, rural, poor rich so that every individual fundamental rights can be fulfilled.

→ environmental ethics is a branch of environmental philosophy that studies the ethical relationship between human beings and the environment

→ environmental ethics has given a new dimension to the conservation of natural resources

→ environmental ethics is the base of ~~reaso~~ reasoning for eg. the following fields of action within society: environmental protection, animal protection, nature protection, animal rights, sustainability issues

what is meant by environmental ethics?

→ Environmental Ethics is the discipline in philosophy that studies the moral relationship of human beings to the environment and its non-human contents.

→ The development of human civilization needs optimum exploitation of natural resources without causing any permanent damage to the environment.

why is it important to study?

→ Environmental Ethics rests on the principle that there should be an ethical relationship between human beings and the natural environment.

→ Human beings are a part of the environment and so are the other living beings, including plants and animals. They cannot be denied their right to live. They need to be considered as entities with the right to co-exist with human beings.

why is it important to study?

→ Environmental Ethics exerts influence on a large range of disciplines including law, sociology, theology,

Economics, ecology and geography

Ozone-layer

- ⑥ climate change, global warming, acid rain, ozone layer depletion.

Ozone layer

Ozone is a molecule that contains three oxygen atoms. Ozone layer, also called ozonosphere, is a region of the upper atmosphere, between roughly 15 and 35 km (9 and 22 miles) above Earth's surface, containing relatively high concentrations of ozone molecules (O_3). Approximately 90% of the atmosphere's ozone occurs in the stratosphere.

Unit - 7

Human population and the environment.

Introduction

- About 250 years ago, humanity existed relatively small numbers with limited technologies.
- Any environmental disturbances caused by people were local and usually well within in the environments capacity to absorb them.
- In the last two centuries, developments have occurred that have created environmental problems beyond nature's assimilative capacity.
- Explosive growth of ~~pop~~ population creates environmental pressure because of the sheer number of people on earth.

POPULATION

- A population is defined as a group of individuals belonging to the same species which live in a given area at a given time.
- A study of population change is known as population dynamic.

Population Density :-

- It is expressed as the number of individuals of the population per unit area or per unit volume.
- This varies in response to changes in the environment and introduction with other living organisms.

Parameters Affecting Population Size

Birth rate :- Number of live births per 1000 people in a population in a given year.

Death rate or mortality

Number of deaths per 1000 people in a population in a given year.

Immigration :-

Arrival of individuals from neighbouring population.

Emigration :- Dispersal of individuals from the original population to new areas.

Variation of Population among Nations

- Different regions of the world find themselves at different stages of demographic transition from high to low mortality and fertility.
- Their growth path also differs considerably, resulting in significant shifts in the geographical distribution of the world's population.
- At present the world's population has crossed 7 billions.
- This existing population is also not evenly distributed.
- Less developed countries have 80% population while the developed countries have only 20%.

Population explosion - Family Welfare Program

- Environment related issues that affect our health have been one of the most important triggers that have led to creating an increasing awareness of the need for better environmental management.

→ This development has created several long-term health problems. While better health care has led to longer life spans, coupled with a lowered infant mortality, it has also led to an unprecedented growth in our population which has ~~now~~ negative implications on environmental quality.

value education

→ value education is the process by which people give moral values to each other. It can be an activity that can take place in any human organisation ~~do~~ during which people are assisted by others, who may be older, in a condition experienced to make explicit our ethics in order to ~~so~~ assess the effectiveness of these values and associated behaviours for their own and others long term well-being, and to reflect on and acquire other values and behaviours which they recognise as being more effective for long term well-being of self and others. There is a difference between literacy and education.

Human rights

→ Several environmental issues are closely linked to human rights. These include the equitable distribution of environmental resources, the utilisation of resources and intellectual property rights (IPs), conflicts between people and wildlife especially around PAs, resettlement issues around development projects such as dams and mines and access to health to prevent environment related diseases.

Role of Information technology (IT) in environment and human health

IT in environment:

→ use of GIS (Geographic Information system) and Remote sensing can help in determining the rates, causes and scale of biodiversity loss.

→ Not only the existence of flora and fauna can be detected, even counting of animals like elephants, tigers etc can be done with the help of GIS.

→ GIS can help in the selection of optimum highway or railway routes, dam or reservoir sites, waste disposal sites, major industrial sites etc that can cause minimal disturbance to ecosystem.

IT in human health

→ The application of bioinformatics is in the emerging possibility for the cure of osteoporosis - a crippling disease caused by the breakdown of bone.

→ Bioinformatics played a key role in the final stages of the Human Genome project.

→ DNA databases or data banks having genetic information about populations together with their personal physical characteristics (eye colour, height, weight etc) i.e. finger prints, dental records, medical records, financial records etc. are used by the government departments to identify missing persons by the investigating agencies to identify criminals.