

GE8291
ENVIRONMENTAL
SCIENCE AND
ENGINEERING

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
R-2017

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C 3 0 0 3

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT - II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT - III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and

ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT - IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Benny Joseph, Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, Textbook of Environmental Studies, Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India PVT, LTD, Delhi, 2014.

UNIT - 1

Environment, Ecosystem and
Biodiversity

Unit-I

Environment, Ecosystems and Biodiversity

Ecosystem

"A group of organisms interacting among themselves and with environment is known as ecosystem".

Structure of Ecosystem

An ecosystem has two major components.

1. Abiotic (Non-living) Components
2. Biotic (Living) Components.

1. Abiotic Components - Non-living (physical & chemical) Components of an ecosystem.

Eg. Climate, Soil, Water, Air etc.

2. Biotic Components - Living organisms in an ecosystem.

Eg. Plants, Animals and Micro-organisms.

(i) Autotrophic components.

The members are producers. They synthesize their food through photosynthesis.

Eg. Green plants, algae etc.

(ii) Heterotrophic components

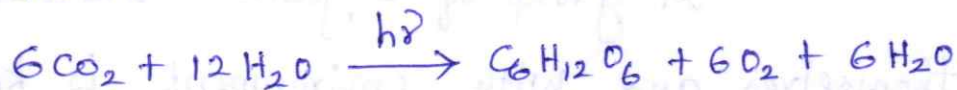
The members are consumers and decomposers. They depend on others for food.

Eg. Animals, Bacteria etc.

Classification of Biotic Components

1. Producers (Autotrophs)

Producers synthesize their food through photosynthesis.



Eg All green plants, trees.

2. Consumers (Heterotrophs)

Consumers are depend directly or indirectly on the producers.

(i) Primary Consumers (Herbivores - Plant eaters)

They directly depend on the plants for their food.

They are plant eaters.

Eg rat, deer, cow etc.

(ii) Secondary Consumers (Primary carnivores - meat eaters)

They depend on the herbivores for their food.

Eg Frog, snake etc.

(iii) Tertiary Consumers (Secondary carnivores - meat eaters)

They depend on primary carnivores for their food.

Eg Tiger, Eagle etc.

3. Decomposers

Decomposers are feed on dead organisms, plants and animals and decompose them into simpler compounds.

Eg. Bacteria and fungi.

Function of an Ecosystem.

The function is to allow flow of energy and cycling of nutrients.

Types of function

1. Primary function - Manufacture of food.
2. Secondary function - Distributing energy in the form of food to all consumers.
3. Tertiary function - Decomposition of dead plants and animals.

Energy flow in the ecosystems

Solar energy is the only source to our planet earth. Solar energy is transformed to chemical energy in photosynthesis by the plants.

Some of the energy utilised by plants for their growth and the remaining is transferred to consumers.

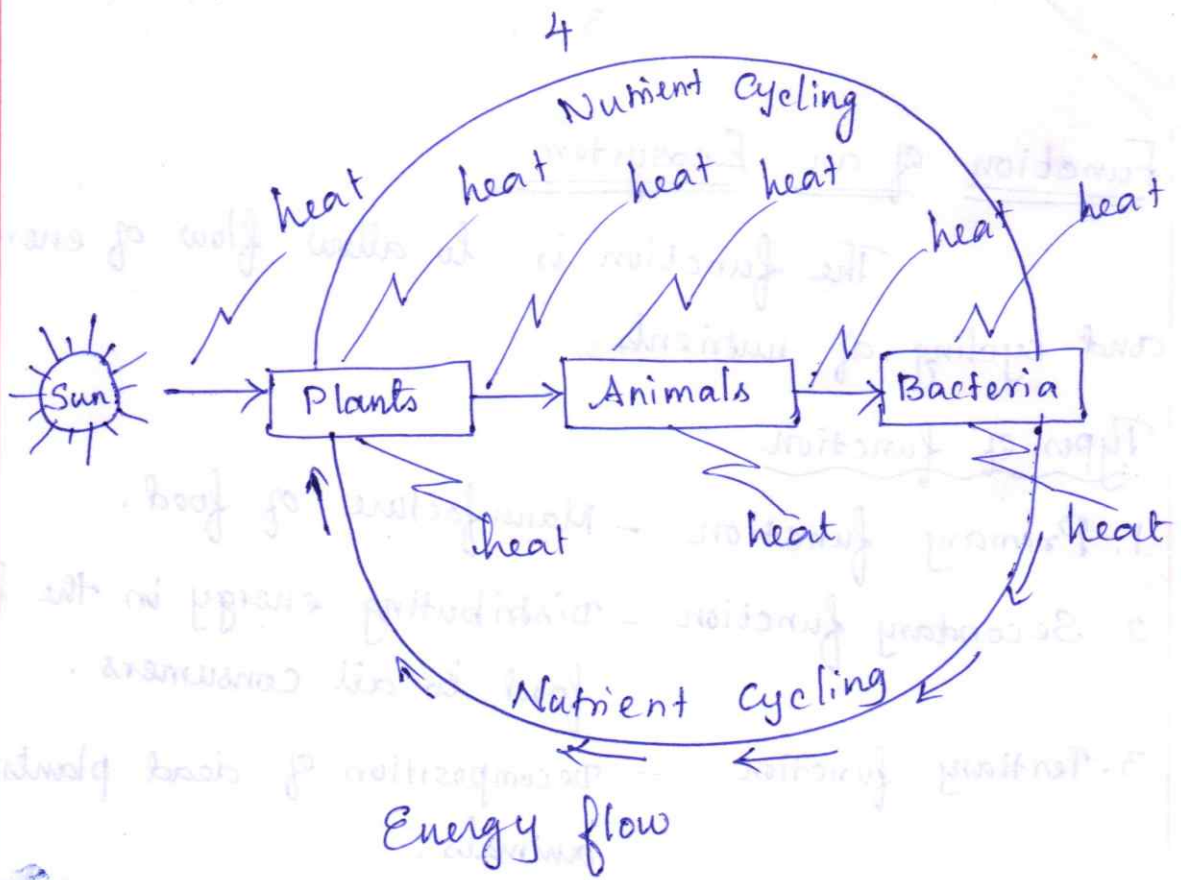
1. 1st law of thermodynamics

"Energy can neither be created nor destroyed, but it can be converted from one form to another"

Solar energy \longrightarrow Chemical energy (plants)

2. 2nd law of thermodynamics

"Whenever energy is transferred, there is a loss of energy through the release of heat"



Ecological Succession

"The progressive replacement of one community by another till the development of stable community in a particular area is called ecological succession".

Stages

1. Pioneer community - First group of organism which establish their community in the area
2. Seres - "Various developmental stages of a community"

Types

1. Primary succession

It involves the gradual establishment of the biotic community on a lifeless ground.

- (a) Hydrarch - establishment in a watery area
 (b) Xerarch - establishment in a dry area

2. Secondary succession.

It involves the establishment of biotic community in an area where some type of biotic community is already present.

Process of ecological succession.

1. Nudation

It is the development of a bare area without any life form.

2. Invasion

Establishment of one or more species by

(i) Migration - Migration of seeds brought about by wind, water or birds.

(ii) Establishment - The seeds germinate and grow.

3. Competition.

As the number of individual species grows, there is a competition with the same species and between different species for space, water and nutrients.

4. Reaction

The living organisms take water, nutrients and grow and modify the environment.

5. Stabilization

It leads to stable community, which is in equilibrium with the environment.

Forest Ecosystem:

Here tall and dense trees grow that support many animals and birds.

Types

1. Tropical rain forest
 - * Found near the equator
 - * High Temperature
 - * Broad leaf trees (teak and sandal)
 - * Animals (lion, tiger)
2. Tropical deciduous forest
 - * Found little away from the equator
 - * Warm climate
 - * deciduous trees (maple, oak)
 - * Animals (deer, fox, rabbit)
3. Tropical scrub forest
 - * Dry climate
 - * Small deciduous trees and shrubs
 - * Animals (deer, fox)
4. Temperate rain forest
 - * Adequate rainfall
 - * Coniferous trees (pine, redwood)
 - * Animals (fox, cat, bear)
5. Temperate deciduous forest
 - * moderate temperature
 - * broad leaf deciduous trees (oak, hickory)
 - * Animal (deer, fox, bear)

Characteristics

- * It maintains climate and rainfall
- * Supports many wild animals
- * Soil is rich in organic matter and nutrients

Structure and function of forest ecosystem

I. Abiotic Components

These are physical components found in the soil and atmosphere.

Eg. Temperature, light, rainfall, minerals.

ii. Biotic components

1. Producers

They synthesize their food through photosynthesis.

Eg. Trees and Shrubs

2. Consumers

(a) Primary Consumers

They directly depend on the producers for their food.

Eg. Ants, insects, squirrels etc.

(b) Secondary Consumers

They depend primary consumers for their food.

Eg. Snakes, birds.

(c) Tertiary Consumers

They depend secondary consumers for their food.

Eg. Lion, Tiger.

3. Decomposers

They decomposes the dead plant and animal matter.

Eg. Bacteria and Fungi.

Grassland Ecosystem

Grassland occupies about 20% of earth's surface. Some trees, shrubs and grass species are present.

Types

1. Tropical grasslands

- * Found near the tropical rain forests.
- * High temperature
- * Tall grasses, shrubs.
- * Animals (zebra, Giraffe)

2. Temperate grasslands

- * Found on flat, sloped hills
- * Very cold winters and hot summers.

3. Polar grasslands

- * found in arctic polar regions.
- * Severe cold, strong winds along with ice and snow
- * small plants
- * Animals (arctic wolf, arctic fox)

Characteristics

- * Soil is Very rich in nutrients and organic matter
- * It has tall grasses, ideal place for grazing animals
- * Uneven rainfall.

Structure and function of the grassland ecosystem

I. Abiotic components

These are non-living things of an ecosystem.

Eg Nutrients, C, H, O, N etc.

ii. Biotic components

1. Producers

They synthesize their food through photosynthesis.

Eg Grasses, shrubs.

2. Consumers

(a) Primary Consumers

They depend producers for their food.

Eg Cows, deer, sheep etc.

(b) Secondary consumers

They depend on primary consumers for their food.

Eg. Snake, birds, lizards.

(c) Tertiary consumers

They depend on secondary consumers for their food.

Eg. Hawk, Eagle.

3. Decomposers

They decompose the dead plant and animal matter.

Eg Bacteria, fungi.

Desert Ecosystem.

It occupies about 35% of our World's land area. It has less than 25 cm rainfall.

Types

1. Tropical deserts

Eg Africa - Sahara desert

Rajasthan - Thar desert

It has only few species. Wind blown, sand dunes are common.

2. Temperate deserts

Eg South California - Mojave

* Very hot summer and Very cool winter time.

3. Cold deserts

Eg China - Gobi desert

* Cold winters and Warm summers.

Characteristics

* Air is dry and climate is hot

* Annual rainfall is less than 25 cm

* Vegetation is poor.

Structure and function of desert ecosystem.

I. Abiotic Components.

Eg Temperature, rainfall.

Temperature is very high and rainfall is very low.

II. Biotic Components

1. Producers

In deserts mostly succulent plants are found. They have water inside them to stay alive. They have waxy layer outside to protect them from the sun.

Eg. Cactus plant, shrubs.

2. Consumers

These animals dig holes in the ground to live in. Most of the animals can extract water from the seeds they eat.

Eg. Squirrels, mice, reptiles.

3. Decomposers

It decomposes the dead organic matter.

Eg. Bacteria and fungi.

Aquatic Ecosystem:

Fresh Water Ecosystem (Pond, Lake, River)

I. Pond Ecosystem

- * It is temporary, only seasonal
- * It is a stagnant fresh water body
- * It gets polluted easily.

Structure and function of Pond Ecosystem.

I. Abiotic Components

These are non-living things.

Eg Temperature, Light

II. Biotic Components

1. Producers

They synthesize their food.

Eg Phytoplankton - small floating plants

Microphytes - large floating plants

2. Consumers

(a) Primary Consumers (Zooplankton)

They depend on plants.

Eg protozoa, very small fish.

(b) Secondary Consumers

They depend on Zooplankton for their food.

Eg Water beetles and small fish.

(c) Tertiary consumers

They feed on small fishes.

Eg Large fish like game fish.

3. Decomposers

They decompose the dead plant and animal matter

Eg Bacteria, fungi.

Lake Ecosystem

* They are large natural shallow water bodies.

Types

- * Oligotrophic lakes - low nutrient concentration.
- * Eutrophic lakes - overnourished by N, P.
- * Meromictic lakes - rich in salts.
- * dystrophic lakes - low pH.

Characteristics

- * shallow fresh water body
- * helps in irrigation and drinking.

Structure and function of lake ecosystem.

I. Abiotic Components

These are non-living things.

Eg. Temperature, light, O_2 and CO_2 .

II. Biotic Components

1. Producers

They synthesize their food through photosynthesis.

Eg. Phytoplankton

2. Consumers

(a) Primary consumers

They feed on phytoplankton.

Eg. Protozoa, zooplankton.

(b) Secondary Consumers

They feed on zooplankton.

Eg. Insects and small fishes.

(c) Tertiary Consumers

They feed on small fishes.

Eg Large fishes like game fish.

3. Decomposers

They decompose - the dead plants and animals.

Eg Bacteria, Fungi.

x — x

River (or) Stream Ecosystem.

Characteristics

* fresh, free flowing water system.

* Do content is more.

Structure and function of river ecosystem.

I. Abiotic Components

They are non-living components.

Eg Temperature, light, nutrients.

II. Biotic Components

1. Producers

They synthesize their food through photosynthesis.

Eg phytoplankton, algae, water grasses.

2. Consumers

(a) Primary Consumers

They feed on phytoplankton.

Eg Water insect, fishes.

(b) Secondary Consumers

They feed on primary consumers.

Eg Birds

3. Decomposers

They decompose the dead animals and plants.

Eg Bacteria and Fungi.

Salt water (Ocean, Estuaries) Ecosystem.

Ocean Ecosystem

It has a high concentration of salts and minerals. It supplies huge variety of sea products.

Characteristics

- * It is rich in biodiversity
- * It occupies a large surface area
- * It moderates the temperature

Structure and Function of Ocean Ecosystem

I. Abiotic Components

They are non-living components.

Eg Temperature, light, NaCl, Mg salts.

II. Biotic Components

1. Producers

They synthesize their food through photosynthesis.

Eg Phytoplankton.

2. Consumers

(a) Primary consumers

They feed on phytoplanktons.

Eg. small fishes.

(b) Secondary consumers

They feed on small fishes.

Eg. Mackerel, Herring, Sard.

(c) Tertiary consumers

They feed on fishes.

Eg. Cod, Haddock.

3. Decomposers

They decompose the dead plants and animals.

Eg. Bacteria, Fungi.

Estuarine Ecosystem

"An estuary is a partially enclosed coastal area at the mouth of a river, where river joins the sea".

Characteristics

- * living organisms had wide tolerance
- * salinity highest in summer and lowest during winter.

Structure and function of Estuarine Ecosystem.

I. Abiotic Components.

They are non-living components.

Eg Temperature, pH.

II. Biotic Components

a) Producers

Producers synthesize their food.

Eg, phytoplankton, sea grasses.

b) Consumers

They feed on phytoplanktons.

Eg. Small fishes, Crabs, seabirds.

c) Decomposers

They decompose the dead plant and animals.

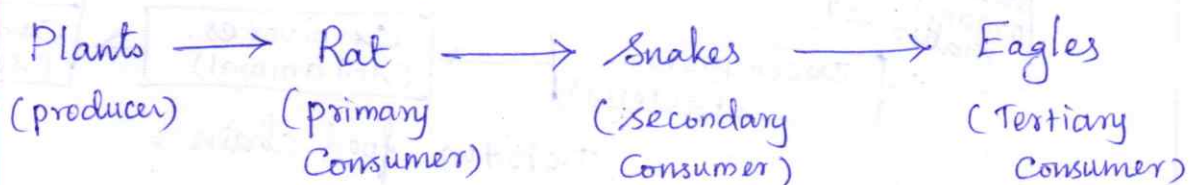
Eg. Bacteria and fungi.

Food Chains

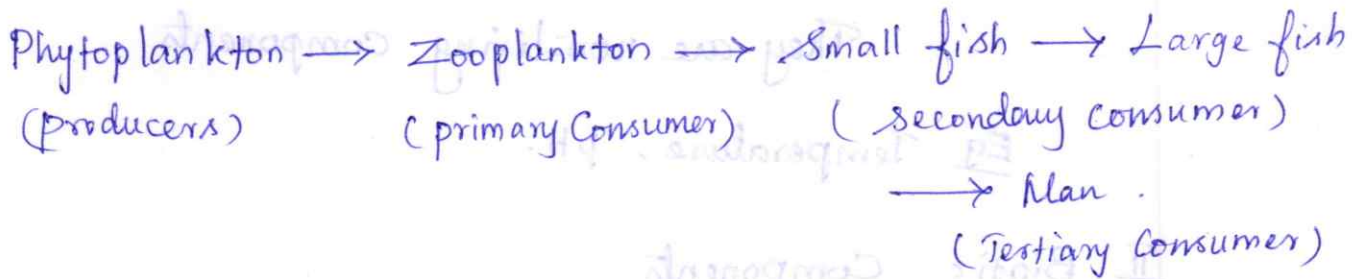
Def:

"The sequence of eating and being eaten in an ecosystem is known as food chain"

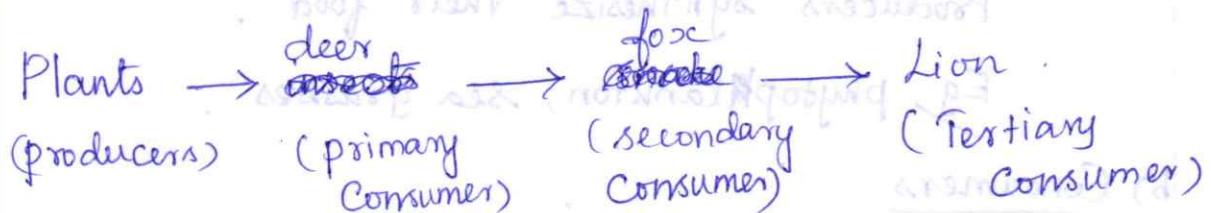
1. Food Chain in grassland



2. Food chain in a pond



3. Food chain in a forest



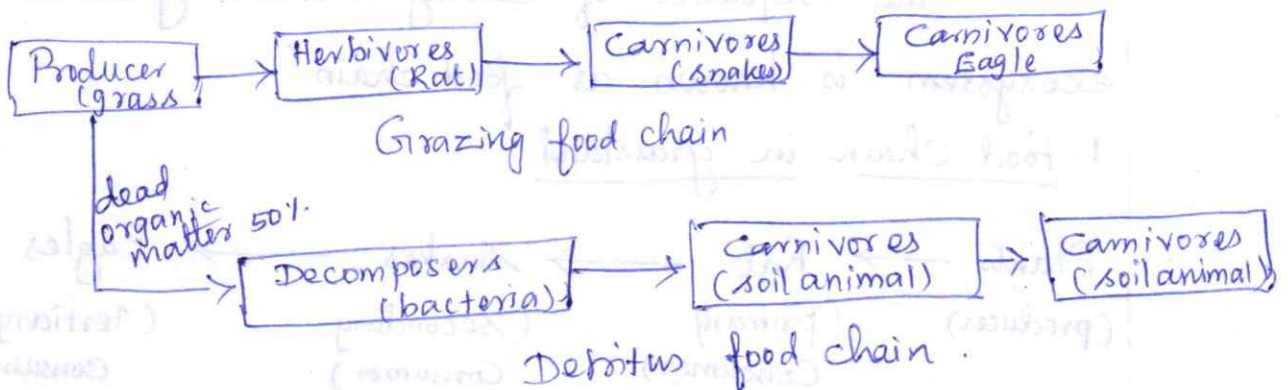
Types of food chain

I. Grazing food chain

Grazing food chain starts with green plants and goes to decomposer through herbivores and carnivores. Found in, grassland ecosystem.

II. Detritus food chain

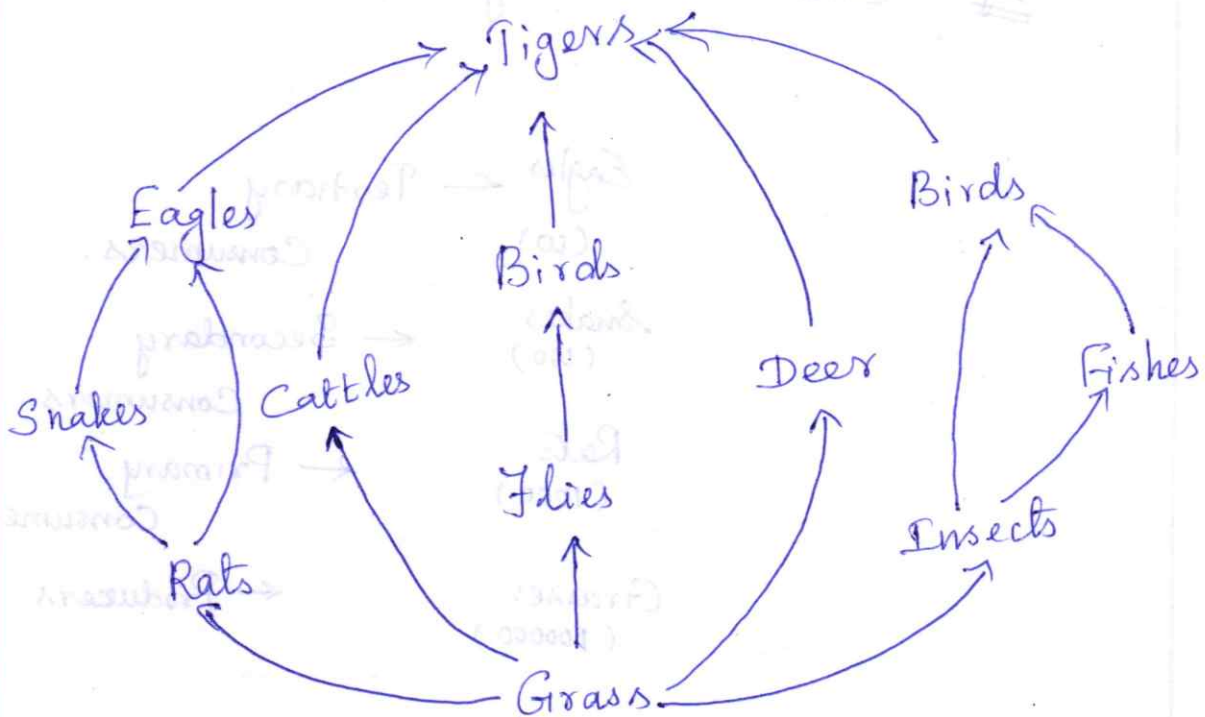
Detritus food chain starts with dead organic matter and goes to decomposer food chain through herbivores and carnivores.



Food Web

"The interlocking pattern of various food chains in an ecosystem is known as food web"

- Eg
- (i) Grass \rightarrow insects \rightarrow birds \rightarrow tigers
 - (ii) Grass \rightarrow deer \rightarrow tigers
 - (iii) Grass \rightarrow insects \rightarrow fishes \rightarrow birds \rightarrow Tigers,
 - (iv) Grass \rightarrow Cattles \rightarrow tigers
 - (v) Grass \rightarrow rats \rightarrow snakes \rightarrow eagles \rightarrow tigers
 - (vi) Grass \rightarrow rats \rightarrow eagles \rightarrow tigers
 - (vii) Grass \rightarrow flies \rightarrow birds \rightarrow tigers.



All the above seven food chains are interlinked with each other at different points, forming food web

Ecological Pyramids

Graphical representation of structure and function of trophic levels of an ecosystem is called ecological pyramids.

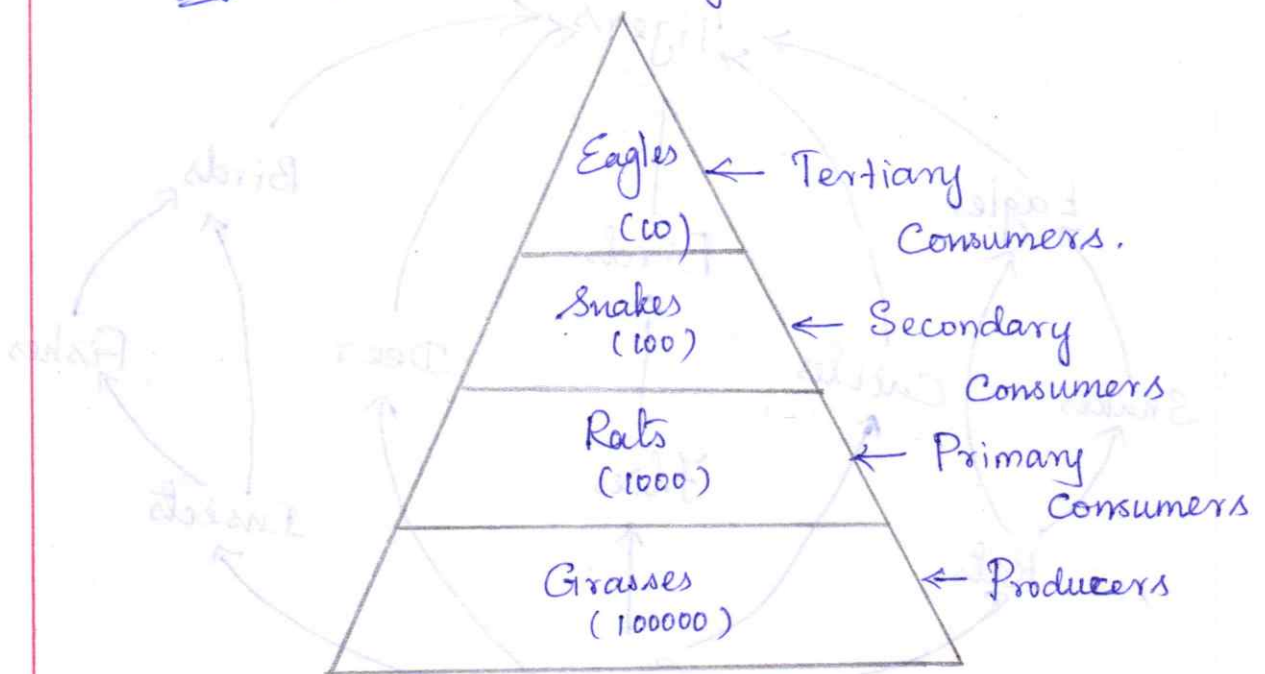
Types

- (i) Pyramid of numbers
- (ii) Pyramid of energy
- (iii) pyramid of biomass.

(i) Pyramid of numbers

It represents the number of individual organisms present in each trophic level.

Eg Grassland Ecosystem



Producers - Grasses → large in numbers → occupy lower trophic level

Primary Consumer - rats → no. of rats are lower than Grasses → occupy 2nd trophic level

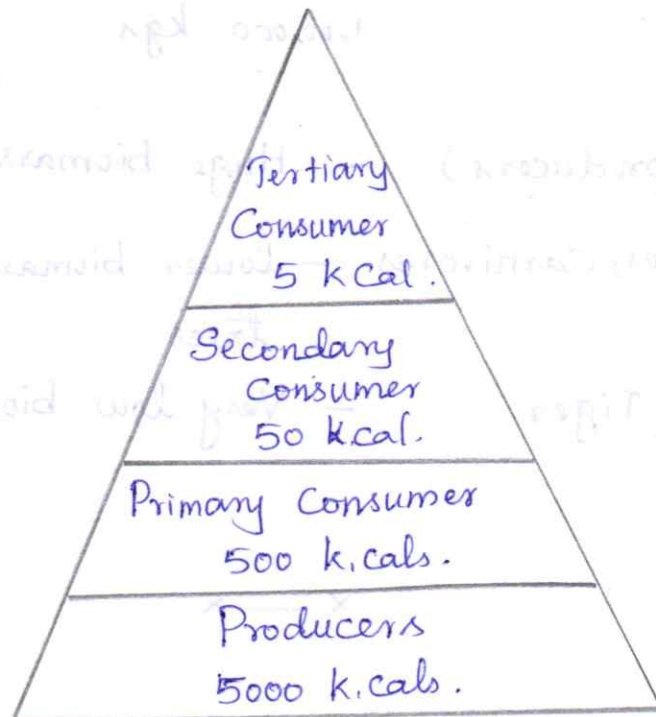
Secondary consumers \rightarrow snakes \rightarrow no. of snakes are lower than no. of rats \rightarrow 3rd trophic level.

Tertiary consumers - Eagles \rightarrow no. of eagles are lower than no. of snakes \rightarrow last trophic level.

(ii) Pyramids of energy

It represents the amount of energy present in each trophic level.

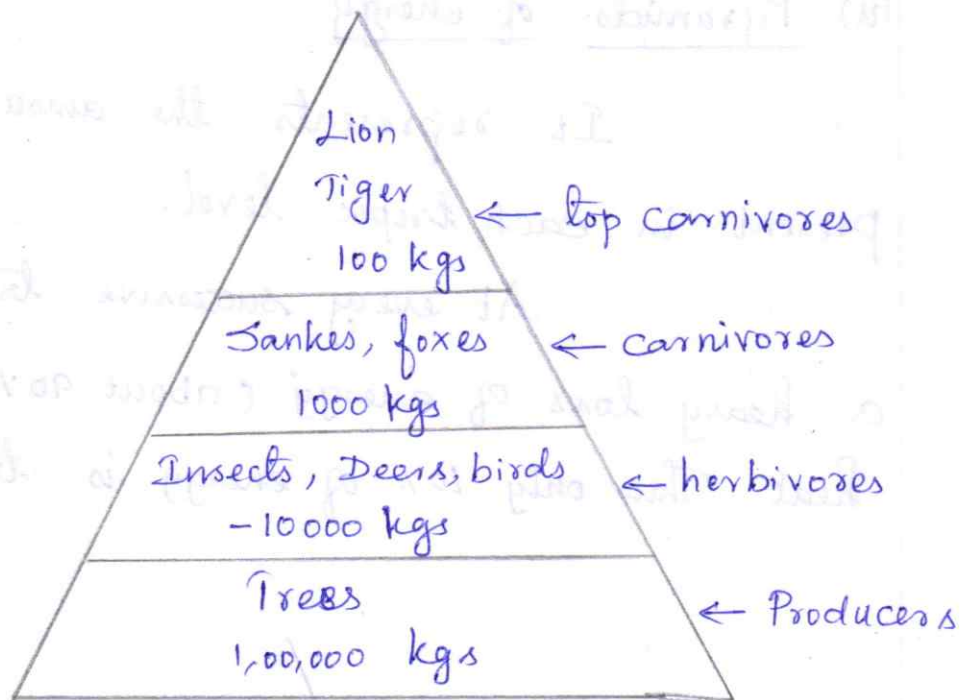
At every successive trophic level, there is a heavy loss of energy (about 90%) in the form of heat. Thus only 10% of energy is transferred.



(iii) Pyramids of Biomass

The amount of living matter present in a particular environment is called biomass.

Eg Forest Ecosystem.



Trees (producers) - Huge biomass

herbivores, carnivores - lower biomass compared to trees.

Lion, Tiger - Very low biomass.

x — x

Biodiversity

Definition

"The variety and variability among all group of living organisms and the ecosystem in which they occur"

Genetic diversity

"Genetic diversity is the diversity within species, i.e., variation of genes within the species"

Eg Rice Varieties - All rice varieties belong to "Oryza sativa" species. But there are thousands of rice varieties. Each differs in size, shape, colour and nutrient content.

Species diversity

"Species diversity is the diversity between different species"

Eg Plant species - Apple, mango, wheat, rice etc.

Ecosystem diversity

"The diversity at the ecological level is known as ecosystem diversity"

Eg River ecosystem.

Value of Biodiversity

Classification

1) Consumptive use Values

These are direct use values, where the biodiversity products are harvested and consumed directly.

Eg (i) Food - Wild plants and animals are consumed as food.

(ii) fuel - firewood, fossil fuel.

(iii) drug - 70% of modern medicines derived from plant and plant extracts.

2) Productive use Values

Some biodiversity products have commercial values. These products derived from animals and plants, these can be marketed and sold.

Eg Animal product Animal

(i) silk silk-worm

(ii) wool sheep

Plant product Industry

(i) wood paper industry

(ii) leather leather industry

3) Social Values

These values are used to the society. These are associated with social life, religion of the people.

Eg Holy plants - Neem, Talsi

Holy animals - Cow, snake.

4) Ethical values

"All life must be preserved". The ethical value means that a species may (or) may not be used, but its existence in nature gives us pleasure.

Eg Existence of Zebra, Giraffe and Kangaroo.

5) Aesthetic Value

The beautiful nature of plants and animals insist us to protect the biodiversity.

Eg Pleasant music of wild birds
Colour of butterfly, flowers.

6) Optional values

These values are presently unknown but need to be known.

Eg The growing biotechnology field is searching a species for causing the diseases of cancer and AIDS.

Threats to Biodiversity

Any change in the ecosystem ~~that~~ threatens and tend to reduce biodiversity.

Various threats to Indian Biodiversity

1. Habitat Loss

The loss of population of interbreeding organisms is caused by habitat loss.

Factors influencing habitat loss

- (i) Deforestation - Many species (plant, animals) loss their home due to deforestation.
- (ii) Destruction of wetlands - due to pollution the wetlands are destroyed.
- (iii) Raw material - Many plants are used as raw materials
- (iv) Habitat fragmentation - Due to this many wild animals and birds are vanishing.
- (v) Illegal trade, production of drugs etc.

2. Poaching of Wild life.

Poaching means killing of animals.

- (i) Subsistence poaching - killing animals for food.
- (ii) Commercial poaching - Hunting (or) killing animals to sell their products.

Factors influencing poaching.

- (i) Human population - It causes degradation of wildlife.
- (ii) Commercial activities - smuggling, trading of wild life products give much profit.
Wild life products - Furs, horns, tusk etc

Remedy measures

- (a) Illegal hunting and trade of animals and animal products should be stopped immediately.
- (b) We should not purchase furcoat, purse (or) bag made of animal skin.

3. Man - Wildlife Conflicts

Man-wildlife conflicts arise, when wildlife starts causing immense damage and danger to the man.

Examples

- (i) In Sambalpur, Orissa, 195 humans were killed in the last 5 years by elephants. In retaliation, the villagers have killed 98 elephants and badly injured 30 elephants.
- (ii) Very recently, two men were killed by leopards in Powai, Mumbai.

Factors influencing man-wildlife conflicts

- (i) Shrinking of forest area.
- (ii) Human encroachment into the forest area.
- (iii) Injured animals have a tendency to attack man.
- (iv) The cash compensation paid by the government for the damage caused by animal is less.

Remedial measures

- (a) Adequate crop compensation schemes must be started.
- (b) Cropping pattern should be changed near the forest area.
- (c) The developmental work in and around forest region must be stopped.
- (d) Adequate food and water should be made available within the forest area.

Conservation of Biodiversity

Types

1. In-situ Conservation (Within habitat)
2. Ex-situ Conservation (Outside habitat)

1. In-situ Conservation

"It involves protection of fauna and flora within its natural habitat" where the species normally occurs is called in-situ conservation.

Important insitu Conservation - Biosphere reserves, National Park, Wild-life sanctuaries, Botanical garden

In-situ Conservation

Numbers available

Biosphere reserves

7

National Parks

80

Wild-life sanctuaries

420

Botanical garden

120

(i) Biosphere reserves

Eg

Nanda Devi - UP

Biosphere reserves cover large area,

more than 5000 sq. km.

It is used to protect species for long time.

Role of biosphere reserves

- * It gives long time survival.
- * It protects endangered species

Restriction

No tourism and explosive activities are

(ii) National Park

It is covering an area about 100 to 500 kms.

Eg Gir - Gujarat - Indian Lion.

Periyar - Kerala - Tiger, Elephant.

Role of National Park.

- * It is used for enjoyment through tourism.
- * It is used to protect wild life.

Restrictions

- * Grazing of domestic animal is prohibited.
- * All forestry activities are prohibited.

(iii) Wildlife sanctuaries

It is reserved for the conservation of animals only.

Eg Vedanthangal Bird Sanctuary - Tamil Nadu - Water birds.

Role of Wildlife sanctuaries.

- * It protects animals only.
- * Forestry activities are allowed, without affecting animals.

(iv) Gene Sanctuary

It is reserved for the conservation of plants.

Eg Northern India - One gene sanctuary for Citrus, one gene sanctuary for Pitcher plant.

(v) Other projects - Project Tiger, Project elephant etc.

Advantages of In-situ Conservation

- * It is a very cheap method
- * The species gets adjusted to natural disasters.

Disadvantages

- * Large surface area is required
- * Maintenance is not proper, due to pollution.

2. Ex-situ Conservation

It involves the protection of fauna and flora outside the natural habitat.

Methods of Ex-situ Conservation

(i) National Bureau of Plant Genetic Resources (NBPGR)

It is located in New Delhi.

It uses cryo preservation technique to preserve crops.

Cryo preservation technique

It involves the preservation of seeds, pollen of some crops using liquid Nitrogen at -196°C . Varieties of rice, onion, tomato etc have been preserved.

(ii) National Bureau of Animal Genetic Resources (NBAGR)

It is located at Karnal, Haryana. It preserves the semen of some domesticated bovine animals.

(ii) National Bureau of Animal Genetic Resources (NBPTCR)

It develops the facility for conservation of varieties of crop plants by tissue culture.

Advantages of Ex-situ Conservation.

- * Animals are assured food, water, shelter and security and hence longer life span.
- * Due to special care and attention the survival of endangered species is more.

Disadvantages of Ex-situ Conservation.

- * It is expensive method
- * The freedom of wildlife is lost.

x — x

Endangered Species

"A species is said to be endangered, when its number has been reduced to a critical level. Unless it is protected and conserved, it is in immediate danger of extinction"

Eg. Blue Whale, Giant Panda.

Endemic species

The species, which are found only in a particular region are known as endemic species.

Eg. Sapria himalayana, Indian salamander.

RED - data book

RED - data book contains the list of endangered species of plants and animals. It gives the warning for those species (endangered) and if not protected they become extinct.

Hot - Spots of Biodiversity

Hot spots are the geographic areas which possess high endemic species.

Criteria for recognizing hot spot

- * richness of endemic species
- * the site is under threat
- * it has special species.

The hot spots covering less than 2% of the World's land and have 50,000 endemic species.

Bio-diversity hot spots in India.

1. Eastern Himalayas - Indo Burma region
2. Western Ghats - Sri Lanka region.

1. Eastern Himalayas

There are 35,000 plant species found in the Himalayas, and of which 30% are endemic.

Eg Rice, banana, citrus, sugarcane etc.

It has

- * 63% of mammals
- * huge wealth of fungi, insects, birds etc.

2. Western Ghats

Nearly 1500 endemic plant species, 62% amphibians and 50% lizards are found here.

Some common plants - Rhododendran, hypericum

Some common animals - blue bird, hawk, lizard.

India as a Mega-diversity nation.

India is one among the 12 mega-diversity countries in the World. It has,

89,450 animals (7.31% of global species)

47,000 plants (10.8% of the World floral species)

<u>Plants/Animals</u>	<u>Number</u>
Algae	2500
Mammals	372
Birds	1228

1. Plant diversity

In India, Flowering plants - 5000

Crop plant = 166

2. Marine diversity

Coral species - 340.

Several species of Mangrove plants and sea grasses are also found in India.

3. Agro-biodiversity

India is considered to be centre of origin of 30,000 to 50,000 varieties of rice, mango, ginger etc.

4. Animal biodiversity

Animal species - 75,000

Insects - 5,000

x — x

Biodiversity at Global, National and Local level.

Global Biodiversity

Total number of living species in the World are about 20 million, but ^{only} 1.5 million species are found and given scientific names.

Terrestrial biodiversity

(i) Tropical rain forest

It has millions of species of plants, insects, birds and mammals.

(a) Medicinal plants - More than 25% of the World's prescription drugs are extracted from plants that is used to treat many diseases including cancer and AIDS.

(b) Flowering plant - Nearly 1,30,000 flowering plants are available in tropical rain forest.

Eg In India - Silent Valley in Kerala.

(ii) Temperate forest

(a) 1,70,000 flowering plants

(b) 30,000 Vertebrates

Marine diversity

Marine diversity is much higher than terrestrial biodiversity.

Jelly fish, Corals	- 10,000
Fish	- 22,000
Algae	- 27,000

Biodiversity at National level.

India gets,

Plant rich countries	- 10 th rank
endemic species	- 11 th rank
agricultural crops	- 6 th rank.

India is considered as 'mega-diversity' nation because it is rich in both flora and fauna.

Medicinal Value - Tulsi, Neem, Turmeric

Commercial Value - Indian sandalwood, tobacco.

Biodiversity at local level

It is divided into four types.

1. Point richness - No. of species found at a single point in a given space.
2. Alpha richness - It refers to no. of species found in a small homogeneous area.
3. Beta richness - No. of species increases as more heterogeneous habitats are taken into consideration.
4. Gamma richness - It refers to the rate of change across large landscape.



UNIT - II

Environmental Pollution.

Air Pollution

Definition

"The presence of one (or) more contaminants like dust, smoke, mist and odours in the atmosphere which are injurious to human beings, plants and animals"

Air Pollutants

1. Primary air pollutants

These are emitted directly in the atmosphere. Eg. CO, NO, SO₂ etc.

2. Secondary air pollutants

It may react with one another and form new pollutants.

Eg. NO/NO₂ $\xrightarrow{\text{Moist}}$ HNO₃/NO₃ etc.

Common air pollutants Sources (causes) and their effects

1. Carbon monoxide (CO)

It is a colourless, odourless gas that is poisonous to air-breathing animals.



Causes

- * Burning of fossil fuel
- * Motor vehicle exhaust (77%)

Health effect

Low level - Headache, anemia

High level - Coma, brain cell damage and death.

Environmental effect

It increases the global temperature

2. Nitrogen di-oxide (NO_2)

It is a reddish-brown irritating gas.



Causes

- * Motor vehicle exhaust (49%)
- * Power industrial plants (49%)

Health effects

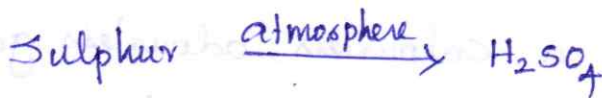
Lung irritation and damage

Environmental effect

- * HNO_3 can damage trees, soils and aquatic life
- * HNO_3 can corrode metals, statues and monuments.

3. Sulphur dioxide (SO_2)

It is a colourless and irritating gas.



Causes

- * Coal burning in power plants (88%)
- * Industrial process (10%)

Health effect

Breathing problems

Environmental effect

- * Reduce visibility
- * Acid deposition - damage trees, soils and aquatic life.

4. Photochemical smog

The brownish smoke like appearance that frequently forms on clear, sunny days over large cities with significant amount of automobile traffic.

Causes

* chemical reaction between NO_2 and hydrocarbon by sunlight.

Health effects

Breathing problems, eye and throat irritation

Environmental effect

Smog can reduce visibility

5. Hydrocarbons

Hydrocarbons especially lower hydrocarbons get accumulated due to the decay of vegetable matter.

Causes

Agriculture, decay of plants

Health effect

Carcinogenic

Environmental effect

plant damage.

Control measures of air pollution

I. Source control

- * Use only unleaded petrol
- * Reduce no. of private vehicles on road
- * Plant more trees
- * Industries should be situated outside the city.

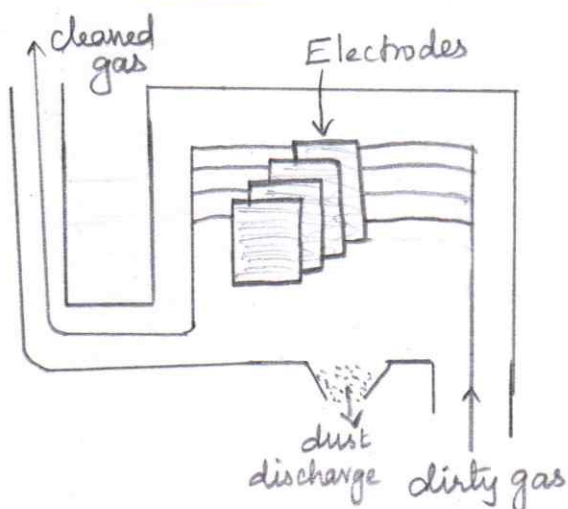
ii. Control measures in industrial centres

- * Emission rates should be restricted to permissible levels
- * Continuous monitoring of atmosphere (to know the emission level)

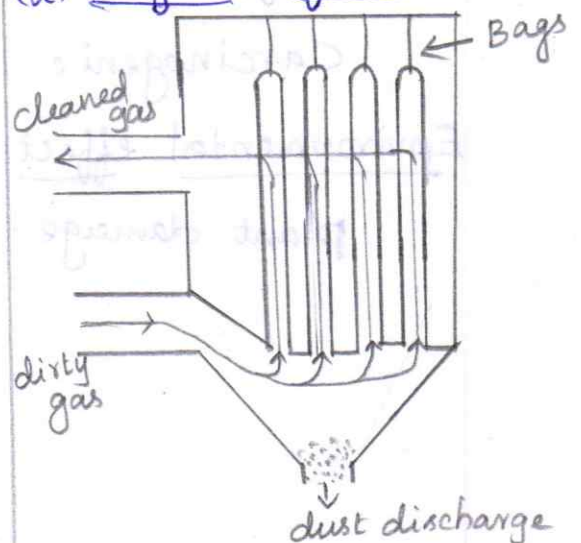
Equipments used to control air pollution.

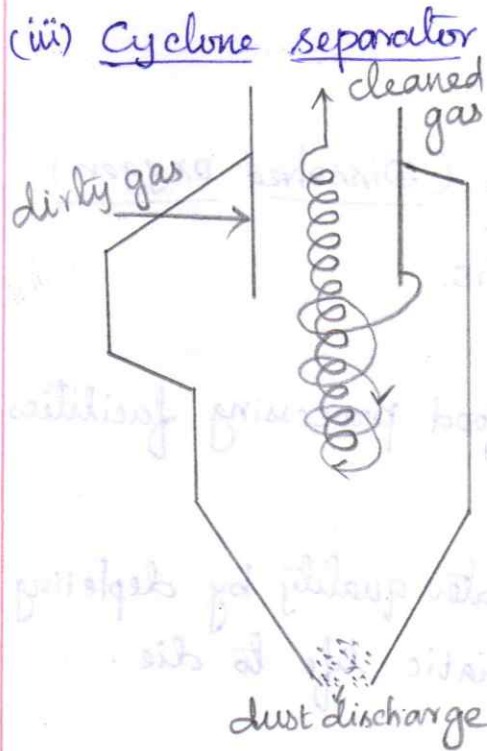
~~fig~~ To use mechanical devices such as scrubbers, cyclones, baghouses and electrostatic precipitators reduce pollutants.

(i) Electrostatic precipitator

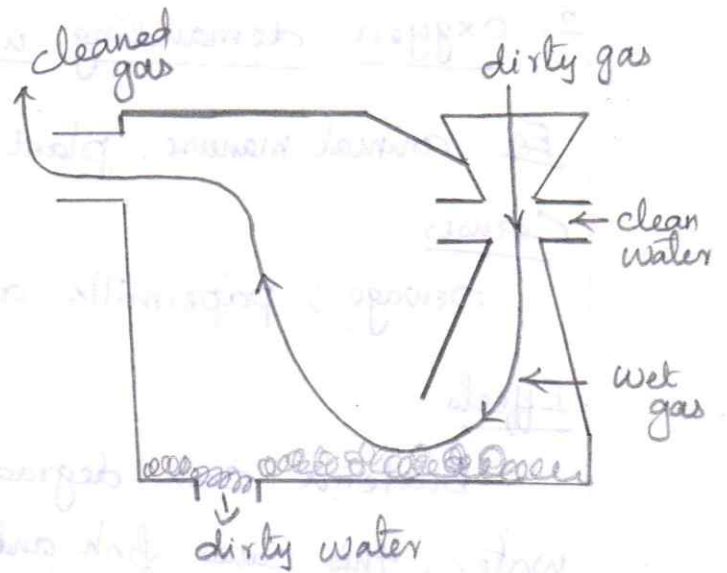


(ii) Baghouse filter





(iv) Wet scrubber.



The above four methods are generally used to remove pollutants from the exhaust gas. The retain hazardous materials (dust) must be disposed of safely.

x — x

Water Pollution

"The alteration in physical, chemical and biological characteristics of water which may cause harmful effects on humans and aquatic life"

Types, Causes and effects of water pollution.

1. Infectious agents

Eg Bacteria, Virus

Causes

Human and animal wastes.

Effects

Variety of diseases.

2. Oxygen demanding wastes (Dissolved oxygen)

Eg animal manure, plant debris

Causes

Sewage, papermills and food processing facilities

Effects

Bacteria can degrade water quality by depleting DO in water, this cause fish and aquatic life to die.

3. Inorganic chemicals

Eg Acids, Compounds of Pb, As and Se.

Causes

Surface runoff, industrial effluents, household cleansers.

Effects

Cause skin cancer, damage the nervous system, harm fish and aquatic life.

4. Organic chemicals

Eg Pesticide, cleaning solvents, detergents.

Causes

Industrial effluents, surface runoff, household cleansers.

Effects

Cause cancer, damage the nervous system, harm fish and aquatic life.

5. Plant nutrients

Eg Nitrate, phosphate and ammonium ions.

Causes

Sewage, agricultural runoff, manure.

Effects

Can cause excessive growth of algae and aquatic plants, which die, decay and deplete DO in water and kill the fish.

6. Radioactive materials

Eg Radioactive isotopes of U, Th, Cs and Rn

Causes

Nuclear power plants, mining

Effects

Genetic mutations, birth defects and cancer.

7. Point and non-point sources of water pollution.

(i) Point sources

These are discharged pollutants at specific locations through pipes, ditches etc.

Eg factories, oil tankers.

(ii) Non-point sources

They are usually large land area, location of which cannot be easily identified.

Eg acid deposition, urban street.

Control measures of water pollution.

- * The administration of water pollution control should be in the hands of State (or) Central government.
- * It is not advisable to discharge any type of waste into rivers, lakes, ponds etc.
- * Public awareness regarding adverse effect of water pollution is a must.
- * The possible reuse and recycle of industrial waste should be encouraged.
- * Scientific techniques to be adopted to control the water pollution.

x — x

Soil Pollution

"The contamination of soil by human and natural activities which may cause harmful effects on living beings"

Types, effects and causes of soil pollution

1. Industrial waste

Sources

Chemical industries, sugar factories, glass, cement industries etc.

Effect

- * alter chemical and biological properties of the soil.
- * enter the food chain and affect living organisms.

2. Urban wastes

It comprises both commercial and domestic wastes.

Eg paper, plastics, leaves, containers etc.

3. Agricultural practices

With the advancing agro-technology huge quantities of fertilizers, pesticides are added to increase the crop yield. Apart from these manure, debris are also causes soil ~~erosi~~ pollution.

4. Radioactive pollutants

Radioactive substance resulting of nuclear waste penetrate the soil and create land pollution.

Eg Th, U, Cs etc.

5. Biological agents

Soil gets large quantities of human, animal and bird's excreta which causes land pollution.

Control measures of soil pollution.

- * Proper dumping of unwanted materials
- * Excessive use of chemical fertilizer and pesticide should be avoided
- * The wastes such as paper, plastics, metal, glasses should be recycled and reused.
- * Ban should be imposed on toxic chemicals and pesticides like DDT, BHC etc.

Marine Pollution

"The discharge of waste substance into the sea resulting in harm to living things, hindrance to fishery is known as marine pollution".

Causes and effects of Marine pollution.

1. Dumping the Wastes

- * Coastal towns and cities dump untreated wastes into sea.
- * Rivers receive huge amount of sewage, garbage, pesticide, then these are all reaches sea.
- * Huge quantity of plastics is being dumped in sea.

Effect

Marine birds consume plastic and they are affected by gastro-intestinal disorders.

2. Oil pollution

- * The great damage to water is imposed by petroleum and its products.
- * Oil enters water from cracks of oil tankers, accidental spillage, cleaning of fuel tank
- * Heavy petroleum products precipitate to the bottom of the sea.
- * One drop of petroleum can spread over a large area and avoid the contact of water from atmospheric oxygen.

- * The oil film inhibits photosynthesis and stops the growth of phytoplankton. Hence the aquatic animals which depend on phytoplankton will be affected.

Control measures of marine pollution.

- * People should be educated about the benefits of marine ecosystem
- * Local Communities must take care of Coastal resources.
- * Industrial units near the Coastal area should have pollution control instruments.
- * Urban growth near the coastal area should be regulated.

Methods of removal of oil

Physical methods

- * Skimming the oil off the surface with a suction device
- * By using suitable absorbing material, floating oil can be absorbed
- * Chemicals can be used to coagulate the oil.

Chemical methods

- * Dispersion
- * Emulsification
- * Using chemical additives.

Noise Pollution

"The unwanted, unpleasant or disagreeable sound that causes discomfort for all living beings".

Normal sound - 35 dB to 60 dB

Noise pollution > 80 dB, 140 dB (painful)

Types and Causes of Noise.

1. Industrial noise.

- * Noise pollution is caused by many machines.
- * Industrial noise, particularly from mechanical saws and pneumatic drill is unbearable and is a nuisance to public.
- * In the steel industry, the workers near the heavy industrial blowers are exposed to 112 dB for eight hours and suffer from the noise pollution.

2. Transport Noise

- * It includes road traffic noise, rail traffic noise and aircraft noise.
- * The number of road vehicles like car, van, bus, truck etc have increased enormously in recent years.
- * The noise level in Delhi, Bombay and Kolkata is as high as 90 dB.

3. Neighbourhood noise

- * Common noise makers are musical instruments, TV, telephone, loudspeakers etc.

Effects of Noise pollution.

- * It causes high blood pressure, mental stress, heart attack, birth defects etc
- * It causes nervous breakdown and high tension.
- * Noise pollution may affect the ear drum and damage the auditory system.
- * Recently it is reported that blood is also thickened by excessive noise.

Control measures of noise pollution.

1. Source control - it includes design changes, limiting the operational timings.
2. Transmission path intervention - construction of a noise barrier along the path.
3. Receptor control : Use personal protection device like ear plugs.
4. Oiling : Proper oiling will reduce the noise from the machines.
5. Planting trees around houses can also act as effective noise barriers.

x — x

Thermal pollution

"Addition of excess of undesirable heat to water that makes it harmful to man, animal or aquatic life is known as thermal pollution"

Sources of thermal pollution.

1. Nuclear power plants

- * Emission from nuclear reactors constitute the major contributor of heat in the aquatic environment.
- * Heated effluents from power plants leads to 10°C rise in water, which affect aquatic plants and animals.

2. Coal-fired power plants

- * The condenser coils are cooled with water from nearby river, and discharge the hot water back to the river increasing the temperature of nearby water by 15°C .
- * It results into killing of fish and other aquatic organisms.

3. Industrial effluents

- * Industries need huge amount of cooling water for heat removal.
- * Discharge from this industries will increase the temperature ranging from 6°C to 9°C .

4. Domestic Sewage

- * The municipal sewage has higher temperature
- * So the dissolved oxygen in water decreases
- * Aquatic ecosystem which depend on the DO will die.

5. Hydroelectric power

Generation of hydroelectric power results in thermal loading in water systems.

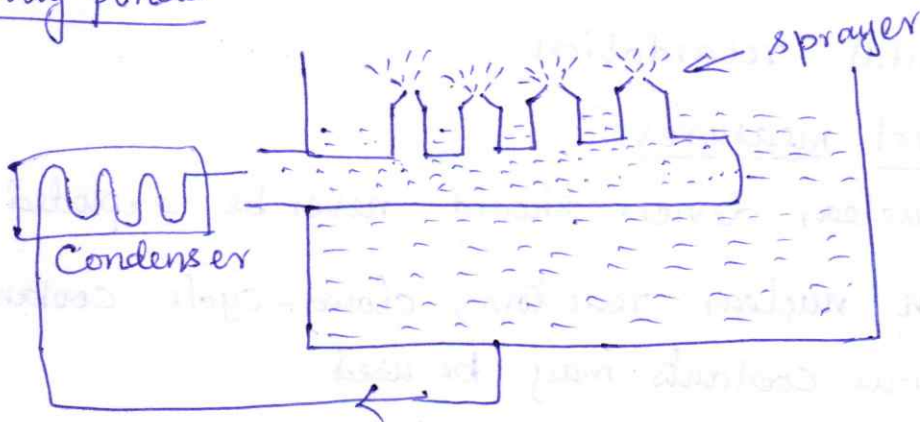
Effects of thermal pollution.

- * Concentration of DO decreases with increase in temperature of water
- * Increase in toxicity : 10°C rise doubles the toxicity of KCN.
- * It affects the digestion, respiration, excretion in aquatic life.
- * Increase in temperature decreases the life span of aquatic animals and plants.

Control measures of thermal pollution.

1. Cooling ponds are simplest method for cooling thermal discharges.

2. Spray ponds



3. Artificial lake

The heated effluents can be discharged into the lake, the heat is eventually dissipated through evaporation.

Nuclear Hazards (Pollution)

Sources

1. Natural Source

2. Man-made source.

1. Natural source

(a) Space - emit cosmic rays

(b) Soil, rocks, air, water etc - Contain one or more radioactive substance.

2. Man-made source

Nuclear power plants, x-ray, Nuclear bombs etc.

Effects of nuclear hazards

(i) High dose of radiation affects brain and nervous system.

(ii) The use of eye is vulnerable to radiation (cataracts)

(iii) Internal bleeding and blood vessel damage.

(iv) Unborn children are vulnerable to brain damage (or) mental retardation.

Control measures

(i) Nuclear devices should never be exploded in air.

(ii) In nuclear reactors, closed-cycle coolant system with gaseous coolants may be used.

(iii) Production of radio isotopes should be minimized.

(iv) Extreme care should be taken in the disposal of industrial wastes.

Disposal methods

1. High Level Waste (HLW)

Eg. Spent nuclear fuel.

* High level nuclear wastes have to be cooled and stored for several decades before disposal.

* The waste should be converted into solids (inert) and then buried deep into earth.

2. Medium Level Waste (MLW)

Ex. Reactor components

MLW are solidified and are mixed with concrete in steel drums, then buried into earth (or) below the sea bed.

3. Low level wastes (LLW)

Ex Solid, liquids with traces of radioactivity.

It is disposed off in steel drums in concrete lined trenches.

X — X

Solid Waste Management

(or)

Soil Waste management

"Any material that is thrown away as unwanted is considered as solid waste. Management of the solid waste is very important in order to minimize the adverse effect of solid waste."

Types and sources of solid waste

1. Urban waste

(a) Domestic waste - from homes

Ex Food waste, waste paper, cloth etc.

(b) Commercial waste - from shops, hotels.

Ex packing material, bottles.

(c) Construction waste

Ex wood, concrete etc.

2. Industrial Waste

(a) Nuclear power plants - radioactive waste

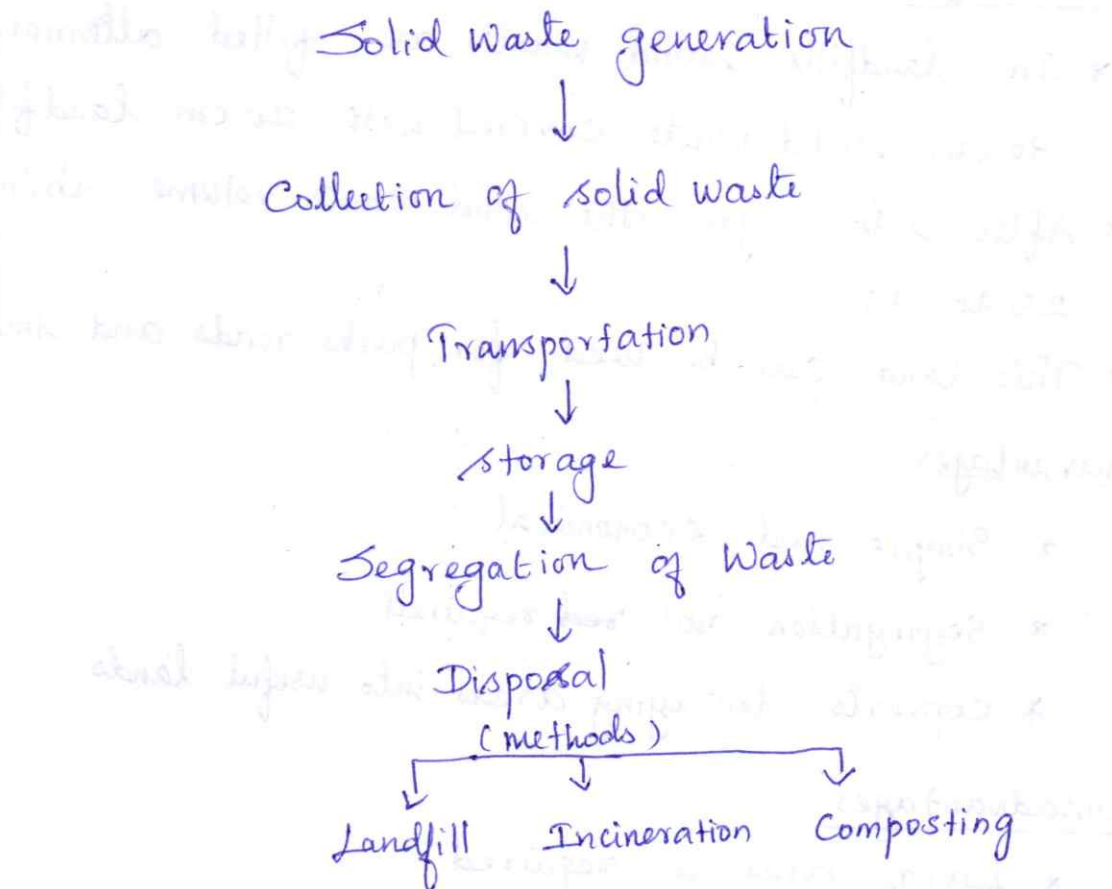
(b) chemical industries - toxic materials

(c) Thermal power plants - produce fly ash.

3. Hazardous waste

Waste from petroleum refineries, paper mills, chemical manufacturing company etc.

Process of solid waste management



Steps involved in Solid waste management

I. Reduce, Reuse, and Recycle - (3R-approach)

- (a) Reduce - Generation of waste must be reduced.
- (b) Reuse - the refillable containers, cycle tube can be reused.
- (c) Recycle - here discarded material converted to useful product. Ex. Glass, paper.

ii. Discarding Wastes.

Methods of disposal of solid waste

1. Land fill
2. Incineration
3. Composting

1. Landfill

- * In landfills solid wastes are filled alternatively - 80 cm solid waste covered with 20 cm landfill.
- * After 2 to 3 yrs the solid waste volume shrinks by 25 to 30%.
- * This land can be used for parks, roads and small building

Advantages

- * Simple and economical
- * Segregation not ~~red~~ required
- * Converts low lying areas into useful lands.

Disadvantages

- * Large area is required
- * Transportation Cost is high
- * Bad odour - if land is not properly managed

2. Incineration

- * It is a hygienic way of disposing solid waste
- * In this method solid waste are burnt in a furnace called incinerator
- * The non-combustible materials can be left out for recycling and reuse
- * The left out ashes is only about 10 to 20%.
- * The heat produced is used for generating electricity.
- * Incinerate about 100 to 150 tonnes per hour (Temperature . 700 to 1000°C) ,

Advantages

- * It requires very little space
- * Cost of transportation is low (city limits)
- * Safest from hygienic point of view
- * 300 tonnes of waste used for the production of 3MW of power.

Disadvantages

- * Capital and operating cost is high
- * Needs skilled personnel
- * Formation of dust, smoke cause air pollution.

3. Composting

- * Compostable waste dumped in earthen trenches in layers of 1.5 m and covered with earth of about 20 cm and left for decomposition.
- * For active decomposition, microorganism introduced.
- * Within 2 to 3 days biological action starts, lot of heat is liberated
- * Finally refuse converted into humus.

Advantages

- * The manure can be sold
- * Recycling occurs.

Disadvantages

- * The non-consumables have to be disposed separately.

Role of Individual in prevention of pollution.

1. Plant more trees
2. Help more in pollution prevention than pollution control.
3. Use water, energy and other resources efficiently.
4. Purchase environmentally safe products.
5. Use CFC free refrigerators.
6. Use natural gas than coal
7. Reduce deforestation
8. Remove NO_x from motor vehicle exhaust
9. Increase use of renewable resources
10. Use rechargeable batteries, it reduce metal pollution.
11. Use green manure instead of chemical fertilizers.
12. Reduce garbage by recycling and reuse.

x — x

Pollution Case studies

1. Bhopal gas tragedy (Air Pollution)

- * It happened at Union Carbide Ltd - Manufactures Carbonate pesticides using Methyl Isocyanate (MIC)
- * Due to failure of its cooling system, the reactor exploded and 40 tons of MIC leaked.
- * MIC - toxic gas, lower amounts affects lungs, eyes and higher amounts - cause death

Effects

- * The gas (MIC) spread over 40 sq. km area
- * 5000 persons killed
- * 65000 people suffered from severe eye, respiratory disorders
- * 1000 persons became blind.

2. Gulf War (Marine Pollution)

- * Gulf war was fought between Iraq and US (in Kuwait) from January 16 to February 26 in 1991
- * American fighters dropped a lakh of bombs - force the Iraq army to withdraw from Kuwait.
- * During the retreat of Iraqis they have set fire on 700 oil wells of Kuwait.
- * Oil from well spills out into the sea.
- * The floating oil over sea water covered nearly 80 km long - burning of oil wells nearly 10 months.

- * Released huge amounts of pollutants like CO_2 and SO_2 into the atmosphere.

Effects

- * 1 million birds killed

3. Chernobyl Disaster (Nuclear Pollution)

- * Occur at Chernobyl in USSR 28th April 1986 - the reactor exploded result of uncontrolled nuclear reactions.

- * Radioactive fuel spread out into the surrounding areas.

Effects

- * killed at least 2000 people

- * damage the soil, water and vegetation around 60 km

- * Animals are also affected.

4. Minamata disease (Marine Pollution)

- * Minamata - Small Coastal Village in Japan - Chisso chemical Company produces vinyl polymer plastics.
- * Industry release its effluent into Minamata sea
- * Effluents containing mercury ions converted into methyl mercury - highly toxic - consumed by fishes.

Effects

- * Affects human being through food chain - damage central nervous system

- * Loss of hearing and vision, severe headache

- * Nervous disorders.

Disaster Management

Flood

Definition

"Whenever the magnitude of water flow exceeds the carrying capacity of the channel within its banks, the excess of water overflows on the surroundings causes flood"

Causes of flood

1. Heavy rain, rainfall during cyclone
2. Sudden snow melt also raises the quantity of water in streams.
3. Sudden and excess release of water from dams.
4. Human activities (road, building construction) block the soil and speed up the run off.
5. Clearing of forest.

Effects of flood

1. The houses and properties of the people are washed away.
2. It damages standing crops.
3. It cause great economic loss, health related problems

Flood management

1. By diverting excess amount of water into lakes, river where water is not sufficient.
2. Encroachment of flood ways should be banned
3. River-networking
4. Afforestation
5. Flood warning should be given by Central water Commission

Earthquake

Definition

It is a sudden vibration caused on the earth's surface due to sudden release of large amount of energy stored in the rocks under the earth's crust.

Causes

1. Underground nuclear testing.
2. Decrease of underground water level.
3. Disequilibrium in any part of earth's crust.

Richter scale

Severity of earthquake

< 4	Insignificant
4-4.9	Minor
5-5.9	Damaging
6-6.9	Destructive
7-7.9	Major
More than 8	Great

Effects

1. Collapse houses and other structures
2. Severe earthquake - deformation of ground surface.
3. It causes landslides in hill areas.
4. Tsunami.

Earthquake management

1. By constructing earthquake-resistant buildings in the earthquake prone areas.
2. Wooden houses are preferred.

Cyclone

Definition

"Cyclone is a meteorological phenomena, intense depression forming over the open oceans and moving towards the land".

Different names of Cyclone.

1. Hurricanes - USA, Atlantic
2. Typhoons - Japan, China
3. Cyclones - India, Bangladesh.

Effect of Cyclone.

- * The damage depends on the intensity of cyclone. The damage to human life, crops, road, transport etc could be heavy.
- * It slow down the developmental activities.

Cyclone management

- * Radar system is used to detect the cyclone and is being used for cyclone warning.
- * For observing the exact location of cyclone, every half an hour satellite pictures are analysed.
- * By planting more trees in a coastal area the effect of cyclone was minimised.

Landslides

Definition

"The movement of earthy materials like ~~mud~~ mud, soil, rock from higher region to lower region due to gravitational pull is called landslides".

Causes of landslides

1. Movement of heavy vehicle on the unstable sloppy regions.
2. Earthquake, cyclone creates landslides.
3. Underground mining activities.
4. Erosion in the hilly area due to run-off water during rainy period.

Effects

- * Landslides blocks the roads.
- * Sudden landslides damage the houses, crop yield etc.

Landslide management

1. Unloading the upper parts of the slope.
2. Steepness of the slope can be reduced by developing benches.
3. Improving cultivation in the slopy region.
4. Soil stabilization using some chemical is also effective in weak areas.

Unit - 3

Natural Resources

Forest Resources

It is one of the important renewable resources on this earth.

Uses of forests

- * They are the homes of millions of plants, animals, wildlife.
- * They moderate temperature and weather.
- * They prevent soil erosion.
- * They recycle rainwater and remove pollutants from air.

1. Commercial uses

<u>Name of the product</u>	<u>Uses</u>
(i) Forest supply wood	as fuel
(ii) Many plants	Medicines, drugs
(iii) minor forest products	Gums, dyes

2. Ecological uses

- (i) production of oxygen
- (ii) Reducing global warming - plants absorb CO_2
- (iii) Prevent soil erosion.
- (iv) Regulation of hydrological cycle
- (v) Home for millions of birds, animals and plants.

Over exploitation of forest

- (a) Increasing agricultural production
- (b) Increasing industrial activities
- (c) Increase in demand of wood resources.

Deforestation

Definition

It is the process of removal of forest resources due to natural (or) man-made activities.

Causes of deforestation

1. Developmental Projects

Massive destruction of forest area.

Ex - Big dams, Hydroelectric projects etc.

2. Mining operations

It reduce the forest area.

Ex Mining of mica, coal etc.

3. Raw material for industries

Wood is the important raw material.

Ex. making plywood, boxes, furniture etc.

4. Fuel requirements

Tribal people depends on wood for fuel.

5. Shifting cultivation

Replacement of number of animals and plants leads to disappearance of such species.

6. Forest fires

Thousands of forest area gets destructed.

Effects of deforestation

1. Global warming

Cutting of trees increases CO_2 level in the atmosphere, rising sea level.

2. Soil erosion

Due to deforestation, 6000 million tons of soil get eroded every year in India.

3. Loss of food grain

As a result of soil erosion, the countries lose the food grains.

4. Loss of biodiversity

When the plants no longer exist, animals depend on them for food become extinct.

Preventive measures of deforestation

- * New plants should be planted.
- * Use of wood for fuel should be discouraged.
- * Forest fire must be controlled by modern techniques.
- * Overgrazing of cattle must be controlled.

x — x

Timber extraction

Due to population growth, the people living nearby forest area using wood as fuel.

Uses of timber

- (i) Industries - paper, furniture
- (ii) Developmental activities - boats, railways.

Effects of timber extraction

- * Deforestation
- * soil erosion
- * landslides
- * reduces thickness of forest

Mining

It is the process of extracting mineral resource and fossil fuels.

Types of mining

1. Surface mining - mining from shallow deposits.
2. Underground mining - mining from deep deposits.

Effects of mining

1. It destroy trees, pollutes soil, water and air.
2. Mining sometimes leads to earthquake
3. Noise pollution
4. It reduces the size of forest area.
5. Landslides occur.
6. Pollution of surface and groundwater resources.

Dams and their effects on forests and tribal people.

Dams are massive artificial structure, which built across the river for the storage of water.

In India - More than 1600 large dams.

Effects of dam on forest

1. Large forest area have been cleared.
2. In addition to dams, forest area is also cleared for office buildings, storing materials, accomodation etc.

3. Construction of dams under hydroelectric projects, led to killing of wild animals and destroy aquatic life.

4. Hydroelectric projects are the reason for water borne diseases

5. These projects also causes waterlogging, salinity, reduce the fertility of the soil.

Ex Tehri dam : Submerged 1000 hectares of forest area affects 430 species of plants.

Effects of dam on tribal people.

1. Displacement and cultural changes affect the tribal people both mentally and physically.

2. Tribal people are ill-treated by the modern society.

3. Many of the displaced people, were not resettled or compensated.

4. Generally the body conditions of tribal people cannot be suited with the new areas, they will be affected by many diseases.

Water Resources

Importance (or) Uses of water

- (a) Water is used for generation of power, transportation and recreation in domestic, commercial, agricultural and industrial activities.
- (b) Water is a cheap coolant.
- (c) Water cycle plays an important role in maintaining different forms of water in nature.
- (d) Water is the important component of photosynthesis.
- (e) Water cleans the atmospheric air.
- (f) Water is used for domestic purposes such as drinking, cooking, bathing, washing, cleaning etc.

Overutilisation of Surface and Ground Water

Effects

1. Decrease of ground water

Usage of ground water increases, the ground water level decreases.

Reason

- * Inadequate rainfall
- * Some buildings block the permeable soil zone, hence underground water decreases.

2. Ground Subsidence

Due to this the sediments in the aquifer get compacted and results in sinking of land surface.

Problems

- * Fracture in pipes
- * Structural damage in buildings.

3. Lowering of water table

Due to increased usage of ground water, the water table decreases.

Problem

changes in the speed and direction of water flow

4. Intrusion of salt water

In coastal area, over exploitation of ground water lead to rapid intrusion of salt water from sea.

Problems

This water cannot be used for drinking and agriculture.

5. Drying up of wells

Here, the level of ground water getting deplete at much faster rate than they can be regenerated.

6. Earthquake

Excess use of water leads to earthquake and landslides.

Dams - Benefits and Problems

Benefits

- * Dams are used to control flood and store flood water.
- * To store the rain water
- * It is used for drinking and agricultural purposes.
- * It is used to generate the electricity
- * Fishery can be developed in the dam areas.

Problems

1. Upstream Problems

- * Loss of several plants and animals.
- * Spreading of water borne diseases
- * Displacement of tribal people.
- * Water logging
- * Excessive storage of water leads to earthquake.

2. Downstream Problems

- * Salt water intrusion at river mouth.
- * Reduced water flow due to silt deposition
- * Water logging and salinity due to over-irrigation
- * Sudden collapse of dam totally destroys the nearby villages and cities.

Mineral Resources

Minerals are naturally occurring substance having definite chemical composition and physical properties.

Formation of mineral deposits

- * Due to the biological decomposition of dead organic matter.
- * During cooling of molten rock.
- * Evaporation of sea water.

Uses

1. Construction, Housing, Industrial plants - Fe, Al, Cu, Ni etc
2. Generation of energy - Coal, Uranium etc.
3. Fertilizers - Zinc contains Zn
4. Jewellery - Au, Ag, Pt and diamond.
5. Communication purpose - telephone wires.

Types

1. Surface mining - mining from near-surface deposits.
2. Underground mining - below earth's surface.

Environmental effects of mining.

1. Devegetation and defacing of landscape:

Top soil as well as the vegetation are removed from the mining area.

2. Groundwater contamination:

Many ores on microbial action gives acid. So groundwater becomes acidic.

3. Air pollution:

Smelting and roasting of minerals emits SO_x , SPM, Pb, Cd etc which cause air pollution.

4. Surface water contamination:

The acid mine drainage contaminates with nearby streams or lakes which causes dangerous effects to aquatic life.

Conservation (or) Management of Mineral Resources

- (i) Reuse and Recycling of metals.
- (ii) Economic use of minerals.
- (iii) Search for new deposit.
- (iv) By adopting eco-friendly mining technology
- (v) Substituting the use of rare and costly minerals by abundant and cheaper minerals.

Food Resources

Food is the essential requirement for the human survival.

Major food resources are wheat, rice, potato, fruits, vegetables, meat, fish etc.

Undernutrition and Malnutrition

To maintain good health, large amount of macronutrients (carbohydrate, proteins, fat) and smaller amount of micronutrients (Vit. A, B, Fe, Ca, I) are required.

(i) Undernutrition

Poor people receive less than 90% of minimum dietary calories.

Effect - Infectious diseases, Mental retardation.

(ii) Malnutrition

Deficiency of nutrition (mineral, protein, vitamin) leads to malnutrition.

<u>Deficiency</u>	-	<u>Effect</u>
proteins	-	growth
Iron	-	anemia.

Changes caused by overgrazing and agriculture.

Overgrazing

Eating away the forest vegetation without giving a chance to regenerate is called as overgrazing.

Effects of overgrazing

- * Land degradation
- * Soil erosion
- * Loss of useful species.

Agriculture

It is the growth of plants and animals by adopting modern scientific invention.

Types

- (i) Traditional agriculture - It involves simple tool, water, organic fertilizer which leads to low production.
- (ii) Modern agriculture.

Modern agriculture

Use of

- (i) Hybrid seeds
- (ii) High-Tech equipments
- (iii) Lot of fertilizer and Pesticides.

Effects of Modern Agriculture.

1. Problems in using fertilizers.

(a) Micronutrient Imbalance.

Chemical fertilizer contains N, P, K (macro-nutrients). When excess of fertilizers are used, it causes micronutrient imbalance.

(b) Blue baby Syndrome.

When nitrogenous fertilizers are used, the nitrate concentration in the water gets increased.

Nitrate greater than 25 mg/lit causes "Blue baby Syndrome". It highly affects infant and leads even to death.

(c) Eutropication

N and P fertilizers washed by runoff water and reaches the waterbodies and cause overnourishment. Due to this algae species use these nutrients and rapidly grow. After their death they cause water pollution.

2. Problems in using Pesticides.

(i) First generation pesticide - S, Pb, Hg (control the pest)

(ii) Second generation pesticide - DDT and BHC (kill the pest)

and produce some side effects like,

(a) Death of non-target organism

Pesticide not only kills the target organisms it kill some useful organisms also.

(b) Producing new pests

Some superpests survive even after pesticide spray and they are highly resistant.

(c) Biomagnification

Many of the pesticides are non-biodegradable and keep on concentrating in the food chain.

Qualities of ideal pesticide.

- (i) It should only kill the target species
- (ii) Biodegradable
- (iii) Should not produce new pests.

3. Water logging

Waterlogging can be described as stagnation of water on top of the soil.

Problems

Due to this, the pore-voids of the soil gets blocked, so the roots of the plants do not get adequate ^{air} for respiration.

Causes

- * Excessive water supply to croplands
- * Heavy rain
- * Poor drainage

Remedy

Proper drainage

4. Salinity

A thin layer of salt is deposited on the topsoil, due to the evaporation of water. The saline soil contains NaCl , CaCl_2 , MgCl_2 etc.

Problems in Salinity

Due to salinity, the soil becomes alkaline ($\text{pH} > 8$) and crop yield decreases.

Remedy

Salt in soil can only be removed by flushing with excess amount of good quality water.

X — X

Energy Resources

Classification

1. Renewable energy sources.
2. Non-renewable energy sources.

Renewable energy sources

It can be regenerated continuously. They can be used again and again in an endless manner.

Ex. Solar, Wind, Tidal etc.

1. Solar energy

"The energy that we get directly from the Sun".

Methods of harvesting solar energy

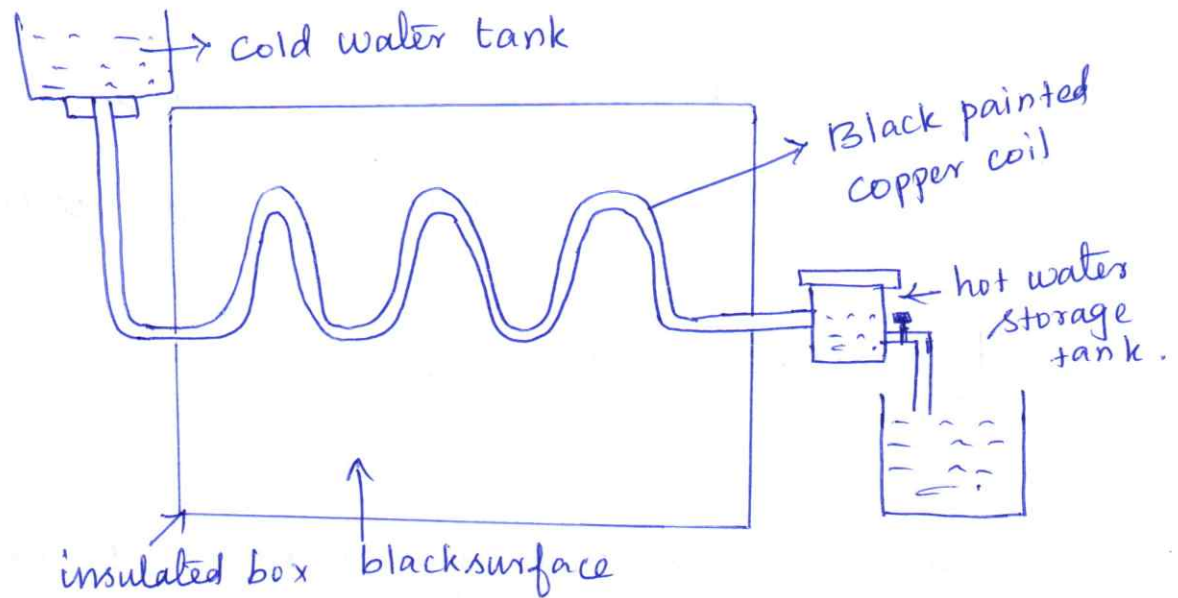
(i) Solar cells Power Plant

By using reflectors, water is converted into steam. The steam turbine drives a generator to produce electricity.

(ii) Solar water heater

It consists of an insulated box inside of which is painted with black paint. It also contains glass lid which is used to receive and store the solar heat. The black painted copper coil is presented

inside the box is allowed to flow in the cold water which gets heated up and flows out into a storage tank.



(iii) Solar heat collectors

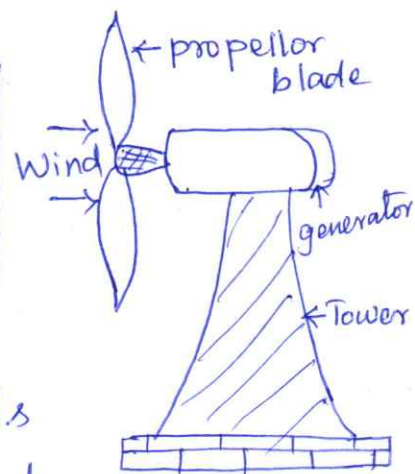
It consists of natural materials like stones, bricks, glass which can absorb heat during the day time and release it slowly at night. It is generally used in cold places.

2. Wind Energy

Moving air is called Wind.

(i) Wind Mills

The strike of blowing wind on the blades of the windmill make it rotate continuously and produce electricity.



(ii) Wind farms

When large number of wind mills are joined together and forms wind farm.

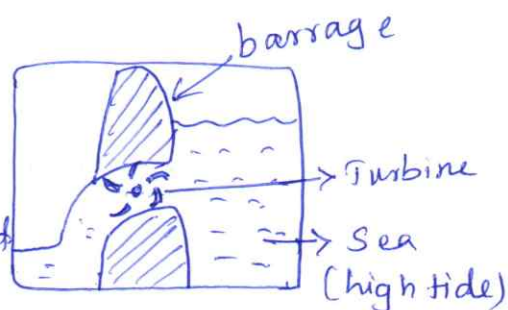
Advantages

- * It is very cheap
- * It does not cause air pollution.

3. Tidal Energy

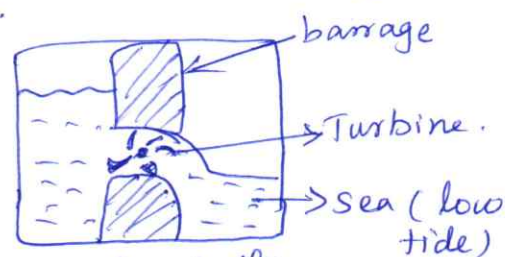
During high tide:

The sea water is allowed to flow into reservoir of barrage and rotate turbine, produces electricity.



During low tide:

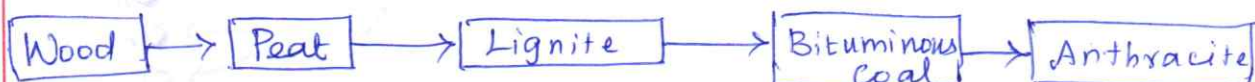
The sea water stored in the reservoir is allowed to flow into the sea and again rotate turbine, produce electricity.



Non-renewable energy sources

1. Coal

Coal is a solid fossil fuel. Various stages are



	<u>Carbon content</u>	
Anthracite	- 90%	(Calorific Value 8700 kcal)
Bituminous	- 80%	
Lignite	- 70%	
Peat	- 60%	

2. LPG

LPG - Colourless odourless gas

To this mercaptans is added, which produce bad odour thereby any leakage of LPG from cylinder can be detected.

3. Natural gas

It is formed by the decomposition of dead animals and plants.

Methane - 50 to 90%.

hydrocarbons - small amount.

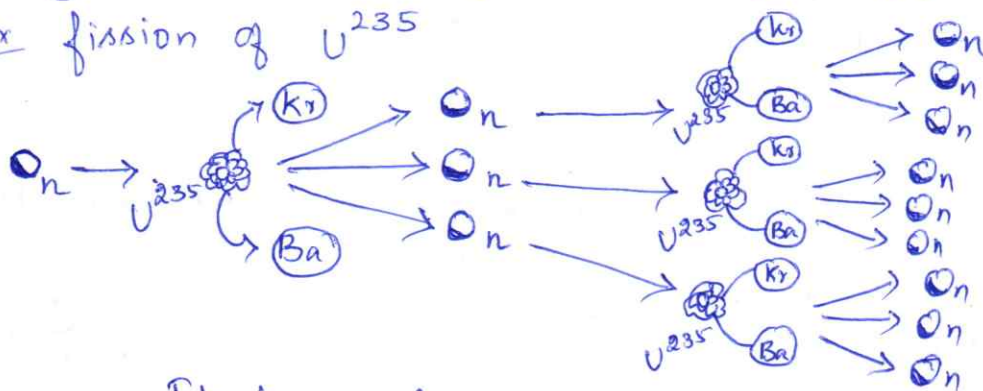
Calorific Value - 12,000 to 14,000 kcal/m³.

4. Nuclear energy

(i) Nuclear fission

When heavier nuclei is bombarded by fast moving neutrons, a large amount of energy is released.

Ex fission of U^{235}

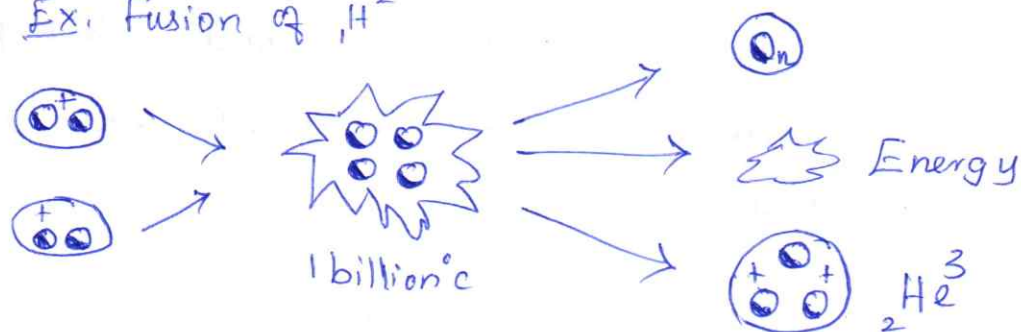


It is a chain reaction. Each of the above 3 neutrons are used to strike another U^{235} and produce 9 neutrons.

(ii) Nuclear fusion

Here lighter nuclei are combined together at high temperature to form heavier nucleus and large amount of energy is released.

Ex. Fusion of H^2



Land Resources

Uses

- * Land provide food, wood, minerals etc.
- * Land nurtures plants, animals and provide food and shelter.

1. Land degradation

"Loss of fertility of the soil" is known as land degradation.

Causes

- * Population explosion
- * Urbanisation
- * Fertilizers and Pesticides
- * Damage of the top soil
- * Water logging, soil erosion.

Effects

- * Soil structure and texture are damaged.
- * Loss of economic, social and biodiversity.

2. Soil erosion

It is the process of removal of superficial layer of the soil.

Causes

- * Water - Rapid flow of rain and surface run-off.
- * Wind - It carries away fine particles of the soil.
- * Construction - dams, buildings, roads.

Effects

- * Soil fertility is lost
- * Loss of its ability to hold water.

Control of soil erosion

①. No-till farming

Here the tilling machines make slits in the unploughed soil and inject seed, fertilizer and water in the slit, the seed germinates and the crop grows.

②. Terracing

Conversion of steep slopes into series of broad terraces, it reduce soil erosion by controlling run-off.

③. Wind breaks

The trees are planted in long rows along the boundary of cultivated lands, which blocks the wind and reduces soil erosion.

3. Desertification

Degradation of arid (or) semiarid lands to desert is known as desertification.

Causes

- * Deforestation
- * Mining
- * Pollution
- * Overgrazing
- * Climate change.

Effects

- * Around 80% of productive land converted into desert.
- * Around 600 million people are threatened by desertification.

Role of an individual in conservation of Natural resources

1. Conservation of energy

- * Switch off lights, fans and other appliances when not in use.
- * Use solar heaters.
- * Dry the clothes in sunlight instead of driers.
- * Plant more trees to reduce the usage of A/c and ~~cooler~~ ^{coolers}.
- * Ride bicycle instead of using car, scooter

2. Conservation of Water

- * Use minimum amount of water for domestic purpose.
- * Check water leaks in pipes.
- * Use drip irrigation.
- * Waste water from kitchen used for watering the plants.

3. Conservation of soil

- * Grow many trees, plants which binds the soil and reduce soil erosion.
- * Use sprinkling irrigation.
- * Use green manure.
- * Use mixed cropping, so some specific soil nutrients will not get depleted.

4. Conservation of food resources

- * Eat only minimum amount of food
- * Don't waste the food
- * Cook required amount of food.

5. Conservation of forest

- * Use non-timber products
- * Plant more trees
- * Grazing must be controlled
- * Avoid construction of dam, road in forest areas.

Unit-IV

Social Issues and the Environment

Sustainable Development

Definition

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs".

Concept for sustainable development

1. Developing appropriate technology

It is an eco-friendly method. It uses local labours, less resources, and produces minimum waste.

2. Reduce, Reuse, Recycle (3-R) approach.

It reduces pressure on our natural resources and reduces waste generation and pollution.

3. Providing environmental education and awareness.

4. Consumption of renewable resources

It is very important to consume natural resources, and that consumption should not exceed regeneration capacity.

5. Conservation of non-renewable resources

By recycling and reusing, it should be conserved.

6. Population Control.

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Urban problems related to energy.

Urbanisation

"It is the movement of human population from rural areas to urban areas for the want of better education, communication, health, employment etc".

Urban sprawl

The people from rural area is moving to cities for education and employment, so the urban growth is so fast and it is difficult to accommodate all the industrial, commercial, residential within the limited area. As a result there is spreading of cities to sub-urban or rural areas. This is known as Urban Sprawl.



Water Conservation

Definition

"The process of saving water for future utilization is known as water conservation"

Need for water Conservation

1. Better lifestyles require more fresh water.
2. As the population increases, the requirement of water is also more.
3. Agricultural and industrial purpose require more water
4. Over exploitation of groundwater, leads to drought.

Measures of water Conservation

1. Reduce irrigation losses
 - (i) Use drip (or) sprinkling irrigation
 - (ii) Use hybrid crop varieties
 - (iii) Irrigation in early morning (or) later evening reduces evaporation losses.
2. Re-use of water
Water from washings, bath-rooms may be used for watering gardens.
3. Prevent wastage of water
 - (i) close the tap when not in use.
 - (ii) Repairing any leakage from pipes.
4. Decreasing run-off losses
This can be done by using contour cultivation (or) terrace farming.

Methods of Water Conservation

- (A) Rainwater harvesting
- (B) Watershed Management.

(A) Rainwater Harvesting

"It is the technique of capturing and storing ^{rain} water for future utilization"

Need of rainwater harvesting

1. To raise the water table.
2. To reduce surface run-off losses.
3. To minimise water crisis and water conflicts.
4. To meet the increasing demands of water.

Concept of rainwater harvesting

* It involves ~~the~~ collecting water that falls on the roof of the house during rain storms.

* Then the rain water is conveyed to the storage unit through PVC pipes.

* A smoother, cleaner roof material contributes to better water quality and greater quantity.

Method of rain water harvesting.

The most common method is roof top rainwater harvesting.

Roof Top Rainwater Harvesting Method. * (Diagram Refer pg. no: 6-10)

* The rainwater from roof of buildings are collected and stored for future use.

* Low cost, effective technique for urban houses.

* The rain water from the roof top as well as surface run-off is diverted into the storage tank and it can be used later for several purposes.

* This rainwater can also be used to raise boxwells water level.

Note: The storage tank (pit) is filled with stones and sand, which serves as a sand filter.

Advantages

1. Rise in ground water level.
2. Increasing the availability of water from well.
3. Minimise the soil erosion, flood hazards.
4. Future generation is assured of water.

(B) Water Shed Management

The management of rainfall and resultant runoff is called watershed management.

Need of Water Shed Management

- * To minimize the risk of floods, droughts and landslides.
- * To protect the soil from erosion by runoff.
- * To raise the ground water level.
- * The water can be used for many developmental activities.

Watershed Management Techniques

① Trenches (Pits)

Trenches were dug at equal intervals to improve groundwater storage.

② Earthen dam

Earthen dam must be constructed in the catchment area.

③ Farm Pond

A farm pond can be built to improve water storage capacity.

x ——— x



Nuclear Accidents and Holocaust

Nuclear Energy and Nuclear Accidents

Nuclear accidents releases large amount of nuclear energy and radioactive products into the atmosphere, which are hazardous to human and environment.

Type of nuclear accidents

1. Nuclear Test

Nuclear Explosion on underground causes,

Earth's surface - settling down radioactive particles

Atmosphere - release of radioactive rays

2. Nuclear Power plant accidents

The release of radiation occurs during the accidents.

3. Improper disposal of nuclear waste

Drums stored underground can rust and leak radioactive materials into water, land and air.

4. Accidents during transport

Trucks carrying radioactive waste involved in accidents.

5. Core melt down:

Major accident in nuclear power plant is "Core melt down".

Effect of Nuclear Radiation

1. Radiations may break chemical bonds such as DNA in cells.
2. Exposure to low dose of radiation (100-250 rads) } - people suffer from fatigue, Vomiting and loss of hair.
3. Exposure to higher dose of radiation (400-500 rads) } - Affect bone marrow, blood cells, blood to fail clot.
4. Exposure to very high dose of radiation (10,000 rads) } - kills the organisms by damaging the tissues of heart, brain.



Nuclear Holocaust

It means destruction of biodiversity by nuclear equipment and nuclear bombs. In a holocaust, a large number of living beings are totally destroyed.

Effect of Nuclear holocaust

1. Nuclear winter

- * Nuclear bombardment cause Combustion of wood, plastics, forest etc.
- * Hence large quantity of black soot was produced, absorb all UV-radiation and hence cooling will result.
- * Thus due to nuclear explosions, a process opposite to global warming will occur.
- * It is called as "Nuclear winter".

Effect of nuclear winter

- (a) lowers the global temperature (around freezing temperature) even in summer.
 - (b) Crop productivity will be reduced.
2. It ignites all combustible material, destroy all the living beings.

Examples for Nuclear holocaust.

1. Nuclear war : ii World War - Attack on Hiroshima - Nagasaki (Japan).

2. At Chernobyl :

- * Occur at Chernobyl in USSR 28th April, 1986 - the reactor exploded - result of uncontrolled nuclear reactions.
- * Radioactive fuel spread out into the surrounding area.

Effects

- (i) killed at least 2,000 people.
- (ii) Damage to soil, water and vegetation around 60 km.
- (iii) Animals are also affected.

Control Measures

- 1. Regular checks are done by Atomic Energy Regulatory Board.
- 2. Constant monitoring of the radiation level.
- 3. Training must be given to people for handling these radioactive materials.

Environmental Ethics : Issues and Possible Solutions

" It refers to the issues, principles and guidelines related to human interactions with their environment "

Function of environment

1. It is the life supporting medium for all organisms.
2. It provides food, air, water etc. to the human beings.
3. It moderates the climate
4. A healthy economy depends on a healthy environment.

Environmental Problems

1. Deforestation.
2. Population growth and urbanisation
3. Pollution
4. Water scarcity
5. Land degradation.

Solutions to environmental problems

- * Reduce the waste
- * Recycle and reuse the waste products
- * over-exploitation of natural resources must be reduced
- * Soil degradation must be minimized.
- * Reduce population.
- * Biodiversity of the earth must be protected.

Ethical guidelines

- * You should love and honour the earth.
- * You should celebrate the earth's seasons.
- * You should not hold yourself above other living things.
- * You should be grateful to the plants and animals
- * You should not waste your resources.

x — x

Climate change

Climate is the average weather of an area. The average of such weather conditions over a long period is called climate.

Causes of climate change

1. Presence of green house gases in the atmosphere increases the global temperature.
2. Ozone layer depletion
3. Uneven rainfall
4. Seasonal changes

Effect of climate change

- * Disturb agriculture and leads to migration of animals.
- * It upset the hydrological cycle

Greenhouse Effect (or) Global Warming

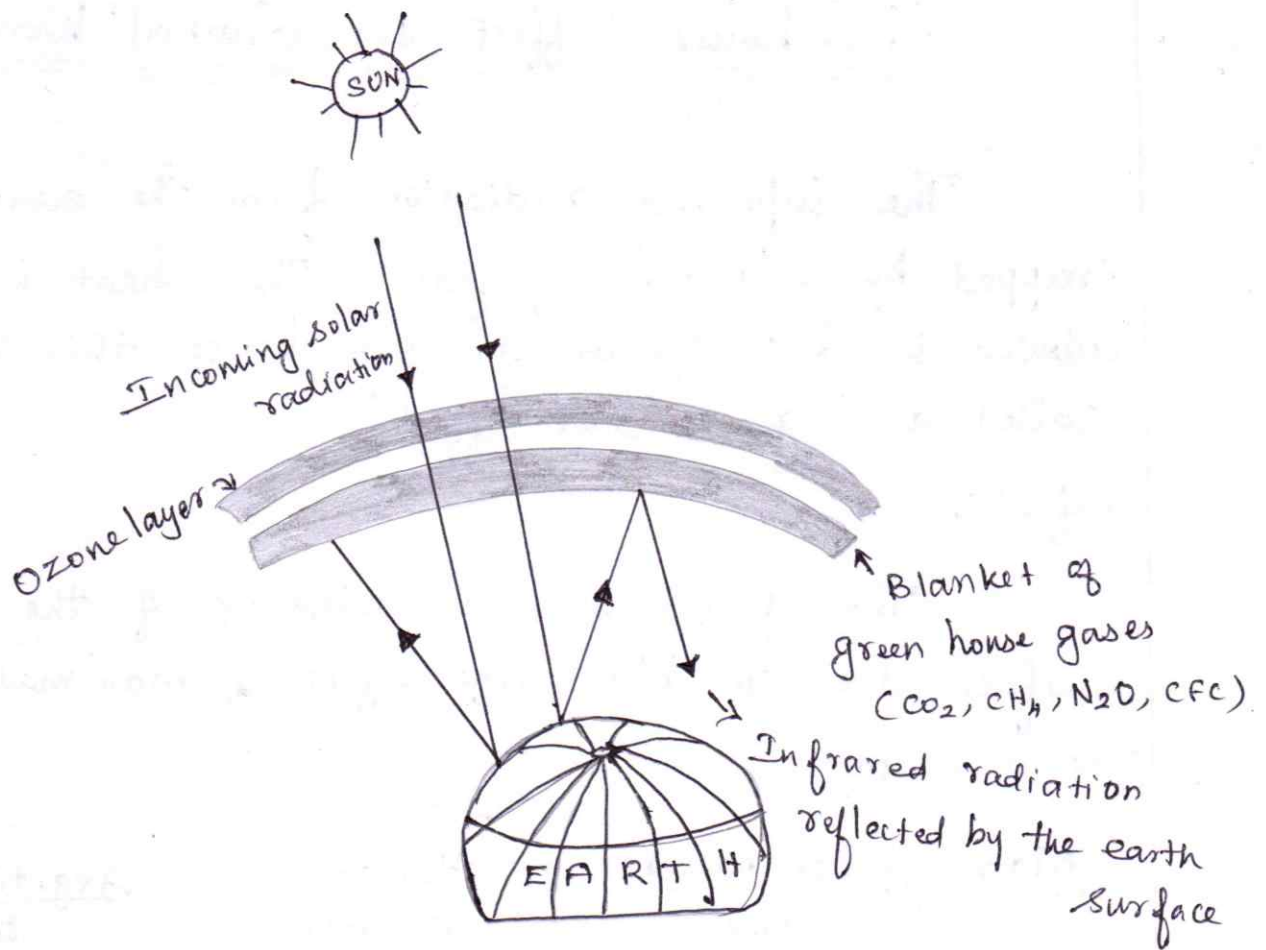
"The infrared radiation from the earth trapped by a number of gases. Thus heat is allowed in but cannot get out - hence this effect called as "green house effect".

Definition

"The progressive warming up of the earth's surface due to blanketing effect of man made CO_2 in the atmosphere".

<u>Major green houses gases</u>	<u>Human Sources</u>	<u>Avg. time in the troposphere</u>
1. nitro Nitrous oxide (NO_2)	Fossil fuel burning	114-120 Yrs
2. Carbondioxide (CO_2)	Fossil fuel burning, plant burning	50-120 Years
3. Chloro fluoro carbons (CFC)	Ac, refrigerators	1-20 Yrs.
4. Methane (CH_4)	Coal production, natural gas leaks.	12-18 Yrs

Among these CO_2 is the most common and important green house gas.



Effect on Global Warming

1. Effect on Sea level - Due to glacial melting, 20 cm rise is expected in sea level by 2030
2. Effect on agriculture and forestry - High CO_2 level have negative effects on crop production and forest growth.
3. Effect on water resources - Drought and floods will become more common.
4. Effect on terrestrial ecosystems - Many plants and animals will be at risk from extinction.
5. Effect on human health - There would be increase in waterborne diseases, infectious diseases.

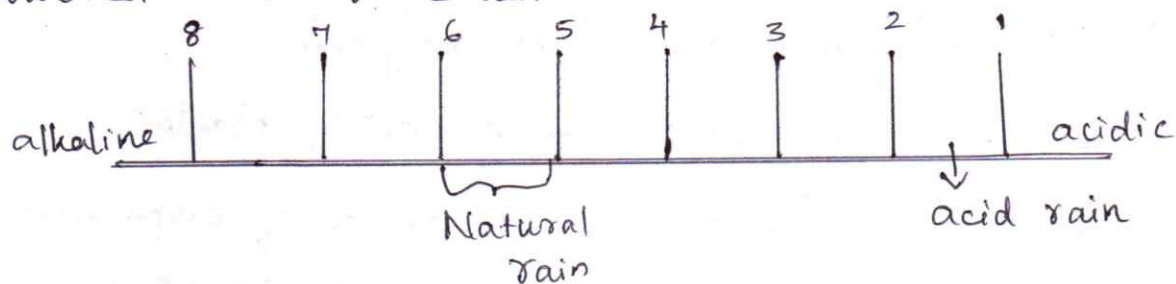
Preventive measures

- * CO₂ emission can be cut by reducing the use of fossil fuels
- * Implement energy conservation measures.
- * Plant more trees.
- * Shift from coal to natural gas
- * Stabilize population growth
- * Use renewable resources

x-x

Acid Rain (or) Acid Precipitation

"Because of the Presence of SO₂ and NO₂ gases in the atmosphere, the pH of the rain water is further lowered. This is called as acid rain (or) acid deposition."

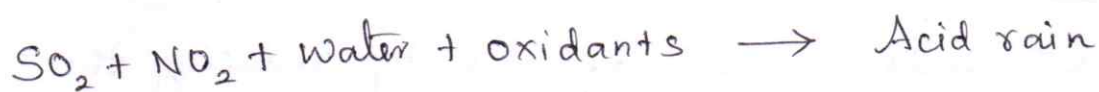


Causes of acid rain

Thermal power plants and industries release NO₂ and SO₂ into atmosphere due to burning of coal.

When these gases react with water vapours in the atmosphere, they form acids and reaches the earth through rain water.





Effects of acid rain

I. On human beings

- * Human nervous system, respiratory system and digestive system are affected by acid rain
- * It also cause premature death from heart and lung disorders.

II. On buildings

- * Taj Mahal is affected due to $\text{SO}_2 \times \text{H}_2\text{SO}_4$ fumes released from Mathura refinery.
- * Acid rain corrodes houses, statues, bridges and fences.

III. On terrestrial and lake ecosystem

- * Acid rain reduces the growth of plants.
- * It severely retards the growth of crops such as reddish, potato, spinach and carrots.
- * Fish population decreases.

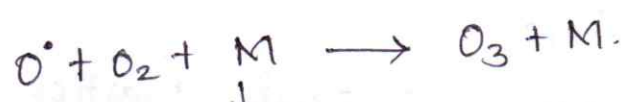
Control measures of acid rain :

- * Improvement in technologies to monitor the air pollution
- * Emission of $\text{SO}_2 \times \text{NO}_2$ from industries should be reduced.
- * Coal with lower sulphur content can be used in thermal plants.
- * Reduce the use of fossil fuels.

Ozone layer depletion (Ozone Hole)

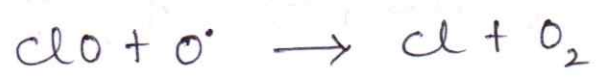
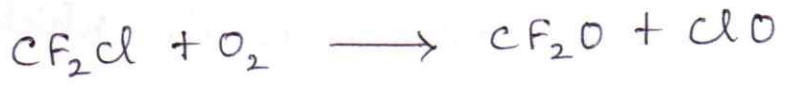
Ozone layer protects us from UV rays of the sun. Recent years ozone holes have developed. So UV rays reaches the earth's surface and causing damage to the human beings.

Formation of Ozone



↓
(third body
such as nitrogen)

Mechanism of Ozone layer depletion



Each Cl atom is capable of attacking several ozone molecules.

Ozone depleting substances

1. Chloro Fluoro Carbon (CFC) - from refrigerators, blowing agent
2. Hydro Chloro Fluoro Carbon (HCFC) - refrigerants, blowing agents.
3. Bromo fluoro carbon - Fire extinguishers (BFC)

Effects of Ozone layer depletion

I. Effect on human health.

- * causes skin cancer
- * Enhanced level UV rays - Cataracts
- * allergies and infectious diseases.

II. Effect on Aquatic system

- affect phytoplankton, fishes

III. Effect on materials

- degradation of paints, plastics

IV. Effect on climate

- Global warming

Control measures

- * Replacing CFCs by other materials which are less damaging.
- * Manufacturing of ozone depleting chemicals should be stopped.

x - x

Waste Land Reclamation

Types of waste lands

1. Uncultivable waste lands:

These lands cannot be brought under cultivation.

Eg. Stonyland, Sandy desert etc.

2. Cultivable Waste lands

These are cultivable but not cultivated for more than five years.

Eg. Waterlogged lands, saline lands etc.

Causes of Waste land formation.

1. Due to soil erosion, deforestation, waterlogging, salinity etc.
2. Developmental activities like dams construction and hydropower projects etc.
3. By the sewage and industrial waste.
4. Mining activities
5. Increasing demand of firewood and excessive use of pesticides.

Need of Waste land reclamation.

1. To prevent soil erosion, landslides and flood etc.
2. To improve the physical structure and quality of the soil.
3. To provide source of income to the rural poor.
4. To supply fuel, fodder and timber for local use.

Methods of waste land reclamation

1. Drainage

Excess water in water-logged soil is removed by artificial drainage.

2. Leaching

It is the process of removal of salt from the soil by applying excess amount of water.

3. Irrigation practices

High frequency irrigation with controlled amount of water helps to maintain better water availability in the land.

4. Green manures and Biofertilizers

Application of green manures helps to improve saline soils.

5. Afforestation programmes

The National Development Board has decided to bring 5 million ~~ha~~ acres of waste land annually for firewood and fodder plantation.

Resettlement

It is simple relocation (or) displacement of human population. This process does not focus on their future welfare.

Rehabilitation (Making the system to work again naturally)

It includes replacing the lost economic assets, safeguard employment, provide safe land for building, repair damaged infrastructure etc.

2 Marks

ENVIRONMENT (PROTECTION) ACT, 1986

This act empowers the central Government to fix the standards for quality of air, water, soil and noise and safeguard for handling of hazard substance

Objectives of Environmental Act

- (i) to protect and improvement of the environment.
- (ii) to prevent hazards to all living creatures
- (iii) to maintain good relationship between human and their environment.

Important features

- * The Government lay down procedures and safe guards for the prevention of accidents which cause pollution, remedial measures if an accident occurs.
- * The Government has the authority to close the industry if the violation of the act occur.
- * Any person who violate the act, they are punishable with imprisonment for 5 yrs (or) with fine up to 1 lakh.
- * If the violation continues, an additional fine of 5,000/day also given.
- * The act fixes the liability of the offence punishable under act on the person who is directly in charge
- * The act empowers the central government officer, to inspect any plant (or) machinery, (or) collect samples of air, water and soil from any factory for testing.

(20) 24

AIR (Prevention and Control of Pollution) Act, 1981

This act gives the power to central and State government to monitor air quality and pollution control.

Objectives

1. To prevent and control of air pollution.
2. To maintain the quality of air.

Important Features

- * The Central Board may lay down the standards for the quality of air.
- * The central board co-ordinates with the State board by giving guidelines.
- * The State board are empowered to lay down the standards for emissions of air pollutant from any industry.
- * The State board can advise the State government to declare certain heavily polluted areas as pollution control areas.
- * The operation of a heavily polluted industrial unit is prohibited by a State board.
- * Violation of law - Imprisonment for 3 months
fine up to Rs. 10,000/- .

This act applies to all pollution industries.

WATER ACT, 1974

This act provides for preventing and controlling water pollution.

Objectives

- * Prevention and control of water pollution
- * Maintaining the sources of water
- * Establishing central and state board for the prevention and control of water pollution.

Important features

- * The act aims at, to protect the water from all kinds of pollution and to ~~prevent~~ preserve the quality of water.
- * The state board are empowered to lay down the standards for discharging any pollutant from industry to water bodies.
- * Any violation of law - prison sentence ranging from 3 months to 6 years.
- * But this act not clear about the definition of pollutant, discharge of pollutant and toxic pollutant.

State Pollution Control Board.

- * Take steps to find out the industry which discharge the effluent to water bodies.
- * Use any new outlet for the discharge of a sewage.

Wild life (Protection) Act

This act is aimed to protect and preserve wild life.

Objectives

- * To maintain life supporting systems.
- * to preserve biodiversity

Important features

- * This act covers the rights and non-rights of forest dwellers (1988)
- * It provides - restricted grazing in sanctuaries
prohibit grazing in National parks.
- * It also prohibits the collection of non-timber forest.

Forest Act (1980)

This act is aimed to conserve forests.

Objectives

- * to protect and conserve the forest
- * to ensure judicious use of forest products.

Important features

- * The reserved forest shall not be dereserved without the prior permission of the Central Government.
- * The land that has been registered may not be used for non-forest purposes
- * Any illegal non-forest activity within the forest area can be immediately stopped under act.

Unit-V

Human Population and the environment

1. Variation of Population among nations

At present the world's population has crossed 6 billions.

	<u>World's Population</u>
Less developed countries (Asia, Africa, Southamerica) }	- 80 %.
Developed countries (USA, Canada, Australia) }	- 20 %.

Variation of population based on age structure.

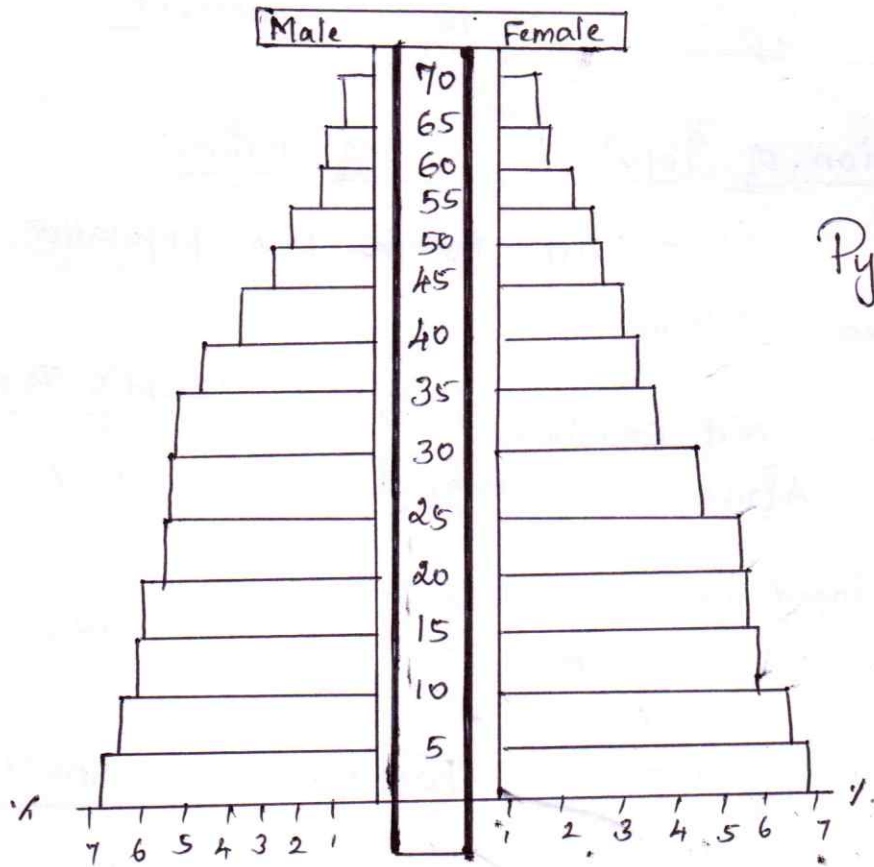
- (i) Pre-productive population (0-14 Years)
- (ii) Reproductive " (15-44 Years)
- (iii) Post reproductive " (above 45 years)

On the above basis, they are explained as follows,

⊕ Pyramid shaped Variation of Population : (Increase)

Eg. India, Bangladesh, Nigeria etc.

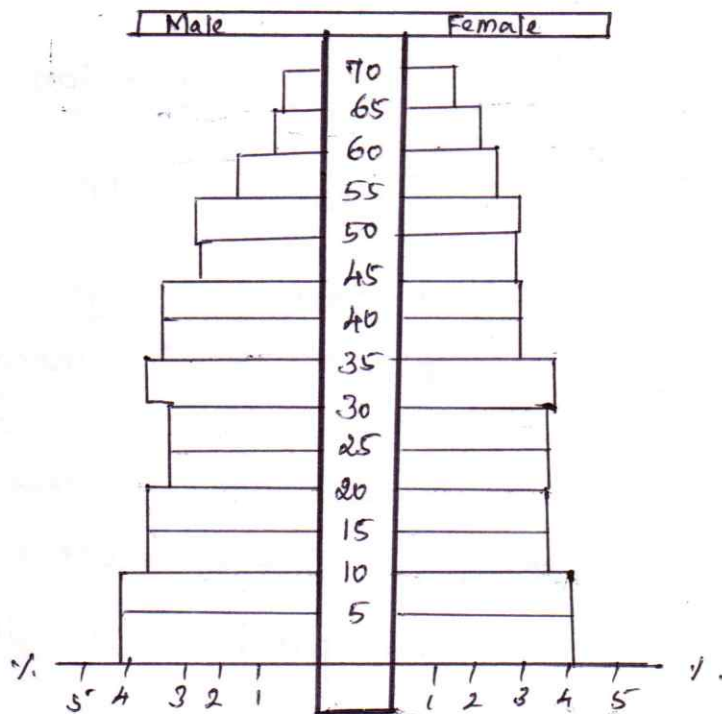
- * Base of pyramid - preproductive age group (0-14 Yrs) population is more.
- * Top of pyramid - Post-reproductive age group (>45 Yrs) population is less.
- * Soon pre-productive enter into reproductive age group, and hence increases the population growth.



Pyramid Shaped
Variation of
Population.

② Bell Shaped Variation of Population (Stable)

Eg France, USA, UK, Canada etc.

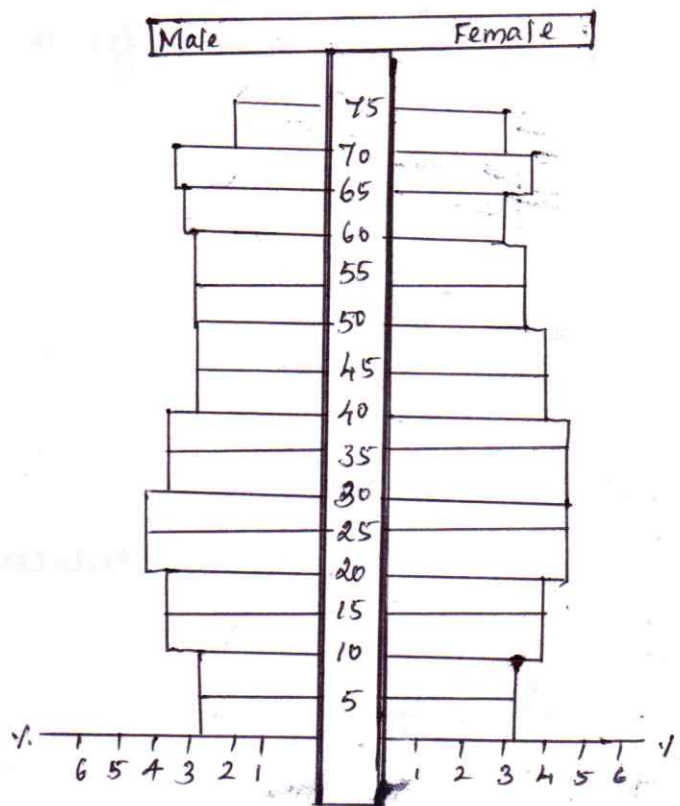


* The pre-productive age group (0-14 Yrs) and reproductive age group (15-44 Yrs) population are more (or) less equal.

* Thus the population growth is stable.

③ Urn Shaped Variation of Population : (decrease)

Eg Germany, Italy, Japan etc.



* The pre-productive age group population (0-14 Yrs) is smaller than the reproductive age group population (15-44 Yrs).

* So after 10 years, there is decrease of population growth.

← →

Population explosion

Definition :

The enormous increase in population, due to low death rate and high birth rate is known as population explosion.

Doubling time

"The number of years needed for a population to double in size"

India - 28 Yrs

US - 87 Yrs.

UK - 231 Yrs.

Causes of population explosion

- * Invention of modern medical facilities reduces the death rate, increases the birth rate.
- * Increase of life expectancy.
- * Illiteracy.

Effect of population explosion

1. Poverty
2. Over exploitation of natural resources.
3. Many of the renewable resources like forest, grasslands are under threat.
4. Lack of water supply, education, sanitation etc.
5. Unemployment.
6. Increase in population increases diseases.

Family Welfare Programme.

Objectives

- ① Slowing down the population explosion by reducing fertility
- ② Over exploitation of natural resources, is reduced.

Family Planning Programme

It provide information on birth control and health care for pregnant women and infants.

Objectives

- * Reduce mortality rate
- * Achieve 100% registration of births, deaths and marriages.
- * Enables to improve women's health, education, employment.
- * Making family planning available to all women.
- * Promote small family norms
- * Prevent AIDS/HIV
- * Making school education upto age 14 free and compulsory.

Methods of family planning.

1. Traditional Method

Some traditions like taboos and folk medicine are included.

2. Modern method

(i) Permanent method

It is done by minor surgery.

- (a) Tubectomy (female sterilization) - tying the tube that carry the ovum to the uterus
- (b) Vasectomy (Male sterilization) - tying the tube that carry the sperm.

Both are very simple procedures done under local anesthesia.

2. Temporary method.

(a) Condoms

It is used by males to prevent sperms.

(b) Copper Ts

It is placed in the uterus so that the ovum cannot be implanted. They do not disturb any functions in the woman's life.

(c) Oral Contraceptive pills.

Family planning programme in India.

- ① In 1952 - India started the family planning programme.
- ② In 1970 - Indian government forced family planning Campaign all over the country.
- ③ In 1978 - Minimum age of marriages
Men - 21 years Women - 18 years.
- ④ In 1981 - Census report showed that there was no drop in population.

x — x

Important hazards and their health effect
 (physical hazard
 chemical "
 Biological ")
 (refer Unit - I notes)

Human Rights

These are possessed by all human beings irrespective of their caste, nationality, sex and language.

Main declarations of human rights are as follows;

1. Human right to freedom.
2. Human right to property
3. Human right to freedom of religion
4. Human right to culture and education
5. Human right to Constitutional remedies
6. Human right to equality
7. Human right against exploitation
8. Human right to food and environment
9. Human right to good health.

1. Human right to freedom.

- * Every citizen has the freedom to assemble at any places to express their views.
- * They have freedom build their houses wherever they like, start any profession
- * They have freedom to form unions.

Article 19 - It provides for freedom of speech and expression.

2. Human right to property

Every Citizen has the right to earn property.

3. Human right to freedom of religion

Every citizen has the freedom to choose their religion, all religions are equal before the law.

4. Human right to culture and education

All the citizen have their own rights to conserve the culture, language and to establish educational institutions of their own choice.

5. Human right to constitutional remedies

If a citizen is denied any of these fundamental rights, they can go to the court for protection.

6. Human right to equality

All citizens are equal before the law.

Article 14 - It provides for equality before law.

7. Human right against exploitation

Children should not be employed as labours.

Every citizen has the right to fight against exploitation.

Article 24 - It prohibits the exploitation of labour children.

8. Human right to food and environment

All citizens have the right to get healthy food,

safe drinking water and healthy environment.

9. Human right to good health

All human beings have the right to have

very good physical and mental health.

Value Education

It is an instrument used to analyse our behaviour. It teaches our youths to be helpful, loving, generous and tolerant.

Objectives of value education

- * To know about various living and non-living organisms and their interaction with the environment.
- * To create and develop awareness about the values
- * To improve the integral growth of human being.
- * To form sustainable lifestyle.

Concept of value education

1. Why and how can we use less resources and energy?
2. Why do we need to keep our surroundings clean?
3. Why it is important to save water?
4. Separate our garbage in to degradable and non-degradable types before disposal.

They deal with a love and respect for nature.

Methods of imparting value education

1. Telling

It is the process of developing values, by narration of the situation.

2. Modeling

Here certain individual perceived as ideal values is presented to the learners as a model.

3. Role playing

Acting out the true feeling of the actors by taking the role of another person.

4. Problem solving

It is the method in which a dilemma is presented to the learners asking them what decisions they are going to take.

5. Studying biographies of great man.

It is the study of good deeds of great men.

Types of values

1. Social values: It tells us about the importance of the human condition which is reflected in life.

2. Cultural values

It varies with respect to time and place. It is concerned with right and wrong, good and bad, true and false behaviour of humans.

3. Individual values (Personal principles)

Parents and teachers are the main key to shape our individual values.

4. Global values

Human and nature are interconnected with some special bonds.

5. Spiritual values

These promote conservationism and transform our consumeristic approach.

HIV/AIDS

AIDS - Acquired Immuno Deficiency Syndrome
caused by

HIV - Human Immune Deficiency Virus.

Origin of HIV/AIDS

1. Through African Monkey

It has been believed that the HIV has transferred to humans from African Monkey.

2. Through vaccine Programmes

In Africa - Through HIV contaminated polio vaccine, Small pox vaccine programme.

In Los Angeles & New York - Through hepatitis-B viral vaccine.

Modes of Transmission of HIV

1. Through blood contact with HIV infected person.

2. Using needles (or) syringes contaminated with blood from HIV positive person.

3. Infected Mothers to their babies.

4. Blood transfusion from the infected person at the time of accident.

Factors not influencing transmission of HIV

Tears, food and air, cough, handshake, mosquito, urine, clothes, bathroom, toilet etc.

The HIV enter into the body and destroy the white Blood cells (WBC), and cause many diseases.

Symptoms

Minor

- * Persistent Cough more than one month.
- * General skin disease.
- * Viral infection
- * Fungus infection in mouth and throat.
- * Frequent fever and headache.

Major

- * Fever for more than one month.
- * Cough and TB for more than 6 months.
- * Fall of hairs from the head.
- * 10% of body weight get reduced within a short period.

Control and Preventive measures of AIDS

"Prevention is Better than Cure"

1. Education

Health education should be given to avoid indiscriminate sex, use of sharing razors, needles and syringes.

2. Prevention of Blood borne HIV transmission

Blood should be screened for HIV before transmission.

3. Primary Health Care

AIDS awareness programmes should be encouraged. Training programmes to doctors ~~an~~ should be conducted.

4. Counselling Service

Counselling services should be provided either in person (or) through telephone.

5. Drug Treatment

Seeking early medical care and staying active are very vital in managing HIV. The immune system has to be kept boosted by taking nutritious diet.

Effects of HIV/AIDS

1. Large number of death occurs.
2. More water is required for maintaining hygiene in AIDS affected locality.
3. The people affected by HIV, cannot perform work well due to lack of energy.

"NIMBY" Syndrome.

NIMBY means Not In My Back Yard, which describes the opposition of residents to the nearby location of something they consider undesirable, even if it is clearly a benefit for a many.

Eg An airport.

It benefits a city economically, but no-one wants it near them because of the noise pollution and traffic it generates.

2 Mark

Women Welfare

The main aim is to improve the status of the women by providing opportunities in education, employment and economic independence.

Need of women welfare

1. Generally women suffer gender discrimination and devaluation in home and working places.
2. High number of dowry deaths, rape, domestic violence and mental torture to women.
3. The human rights of women are violated in the society.

Objectives of Women Welfare

1. To provide education
2. To improve employment opportunities
3. To impart vocational training
4. To generate awareness about the environment.
5. To restore status, equality and respect for women.

Objectives of a "National Commission" for Women

- * To examine legal rights for women.
- * To review existing legislations.
- * To sensitize the enforcement and administrative machinery to women's causes.

Various Schemes of Women Welfare:

1. The National Network for Women and Mining.

It is fighting for a "gender audit" of India's mining Companies.

2. United Nations Decade for Women

It witnessed inclusion of several Women Welfare related issues on international agenda.

3. Non-Government Organization as Mahila Mandals

It creates awareness among women of remote Villages, and educate them, help them to become economically self-dependent.

4. Ministry for Women and Child development,

It aims to work for the upliftment of women by family planning, healthcare, education and awareness.

Child Welfare:

Children occupy nearly 40% of total population. They are considered to be the assets of a society.

Reasons for child labours

1. Poverty - It is the main reason to force the children to work in unhealthy conditions.

2. Want of Money - Parents require money for their family so they are in a position to send their children for work.

Various schemes towards child welfare.

1. International law:-

Right of the child

The international law defines right of the child to survival, participation, development and protection.

(a) The right to survival

It emphasizes on good standards of living, good nutrition and health.

(b) The right to participation

It means freedom of thought and appropriate information to the child.

(c) The right to development

childhood care and support, social security

(d) The right to protection

It means freedom from exploitation.

2. World summit on children.

It focus for the well being of the children.

3. Ministry of Human Resource Development

It concentrates on child's health, education, nutrition, clean and safe drinking water and environment.

Centre for Science and Environment

Its scientific report says "children consume more water, food and air than adults, and hence more susceptible to any environmental contamination. So it is essential to keep the cleaner environment."

Role of IT

Role of Information Technology in Environment Protection

Information Technology means collection, processing, storage and dissemination of information.

Softwares for environment education

1. Remote Sensing

It refers to any method, can be used to gather information about an object without actually coming in contact with it. It identifies earth feature by detecting the characteristic electromagnetic radiation that is reflected by the earth.

Ex The remote sensing image of land can be used to derive information of vegetative cover, water bodies, land use, soil etc.

Applications

* In agriculture

Remote sensing gives valuable information for land and water management.

* In forestry

It gives information about density of forest, wood volume and biomass, forest fire etc.

* Water resources

It is used in flood monitoring, water quality monitoring, irrigation water management, snow cover monitoring etc.

2. Database

Database is the collection of ~~de~~ interrelated data on various subjects.

Applications of database

(a) The Ministry of Environment and Forest

(i) They are compiling database on biotic Communities.

(ii) Database also available for HIV/AIDS, Malaria etc.

(b) Environment Information System.

Database gives information about pollution control, remote sensing, desertification etc.

3. Geographical Information System (GIS)

GIS is a technique of superimposing various thematic maps using digital data on a large number of interrelated aspects.

Applications of GIS

- * Interpretations of polluted zones, degraded lands can be made based on GIS.
- * GIS used to check environmental problems.

4. Satellite data

* It gives correct and reliable information about forest cover.

* It provide information of monsoon, smog, ozone layer depletion, new reserves of oil etc.

5. World Wide Web (www)

More current data is available on www.

Important on-line learning center - [www.mhhe.com / environmental science](http://www.mhhe.com/environmental-science).

Applications

- * It gives current and relevant information on principles, problems, applications of environmental science
- * It has digital file of photos, animation, quiz etc.

Role of Information Technology in Human Health Protection

It mainly involves three systems. They are

1. Finance and accounting
2. Pathology
3. Patient administration : clinical system

Applications

- * With the help of IT, the data regarding birth and death rates, immunisation and sanitation programme maintained more accurately.
- * IT helps the doctor to monitor the health of the people effectively.
- * Information regarding epidemic diseases conveyed easily.
- * On-line help of expert doctors, provide better treatment to the patient.
- * With a central control system the hospital can run effectively.
- * Drugs and its replacement can be done efficiently.