(Management Topic in Environmental Studies)

B. Tech 7TH Semester

Multidisciplinary nature and scope and objective of environmental studies

Unit 1

Department: Chemistry

Subject: MTES (CHM 2049)

Contents

Introduction

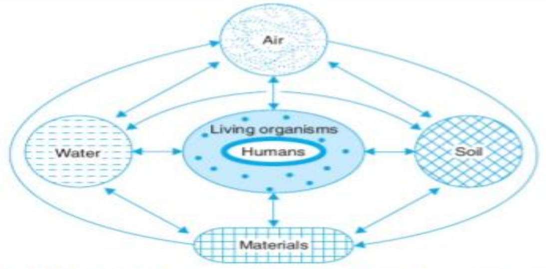


Fig. 1.1 Concept of Environment: air, water, land, living organisms and materials surrounding us and their interactions together constitute environment.

- The word 'Environment' is derived from the French word 'Environner' which means to encircle, around or surround
- **Environment:** The circumstances and conditions surround and affect/ influence the growth and development of a organism.
- Environment is the sum total of land, water, air, interrelationships among themselves and also with the human beings and other living organisms
- 2. Douglas and Holland defined that 'The term environment is used to describe, in aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms'.

Introduction

- Environmental Science: is the interdisciplinary field and it is the study of the interactions among the physical, chemical and biological components of the Environment with a focus on environmental pollution and degradation.

The term 'Ecology' is derived from Greek word 'Oekologue' which is composed of two words:
(a) 'Oekos' means surrounding
(b) 'Logs' means study on a whole ecology means 'Study of surrounding'

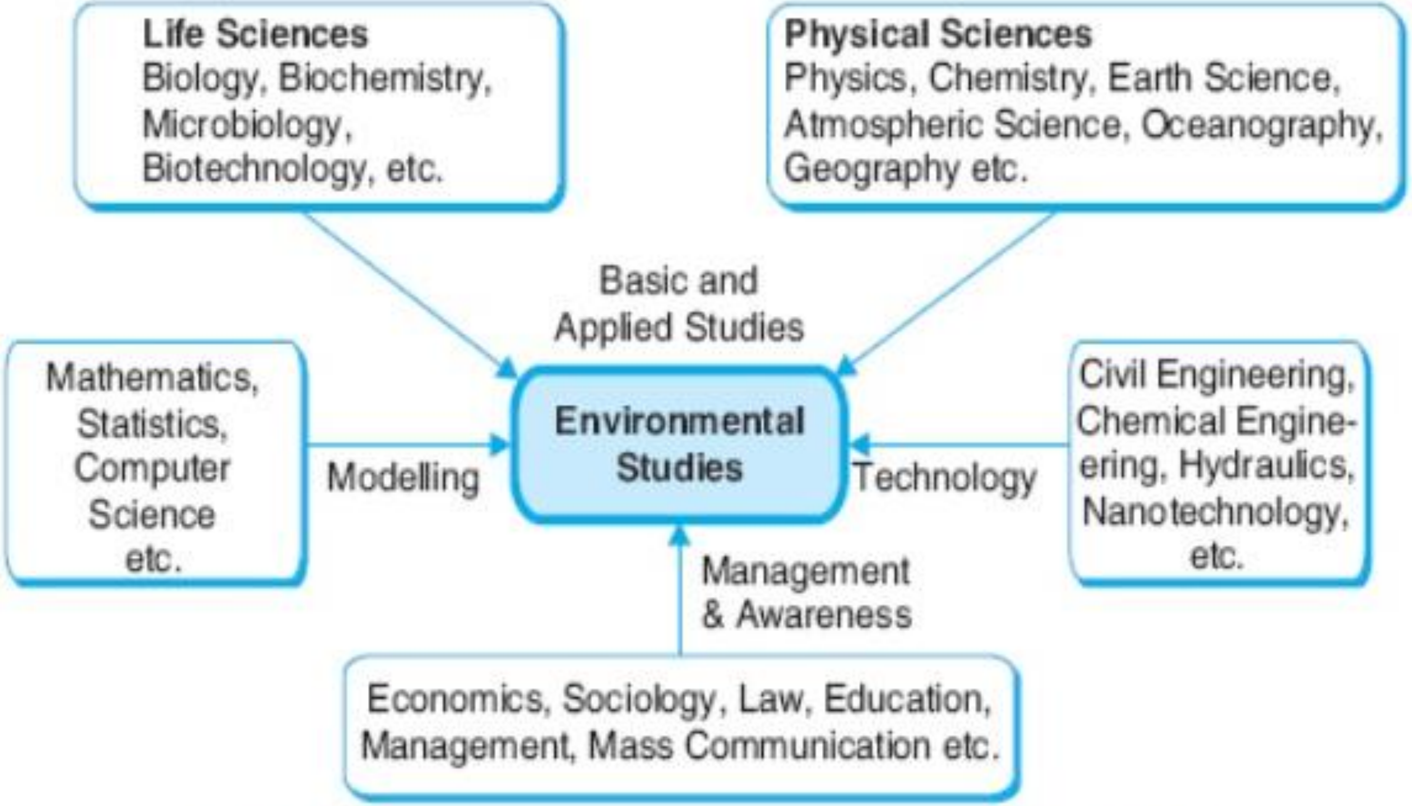


Fig 1.2 Multidisciplinary nature of environmental studies.

Objectives of Environmental Studies

According to UNESCO (1971), the objectives of environmental studies are:

a) Creating the awareness about environmental problems among people and students.
b) Imparting basic knowledge about the environment and its related problems.
c) Developing an attitude of concern for the environment.
d) Motivating public to participate in environment protection and environment improvement.
e) Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
f) Striving to attain harmony with Nature.

Guiding principles of environmental education

According to UNESCO, the guiding principles of environmental education should be as follows:

(a) Environmental education should be compulsory, right from the primary up to the post graduate stage.

(b) Environmental education should have an interdisciplinary approach by including physical, chemical, biological as well as socio-cultural aspects of the environment. It should build a bridge between biology and technology.

(c) Environmental education should take into account the historical perspective, the current and the potential historical issues.

(d) Environmental education should emphasize the importance of sustainable development i.e., economic development without degrading the environment without comprising for the future generation.

(e) Environmental education should emphasize the necessity of seeking international cooperation in environmental planning.

(f) Environmental education should lay more stress on practical activities and first hand experiences.

The disciplines included the following science and engineering principle.

(a) Environmental Science:

- It is the scientific study of the environmental system particularly adoptation and interaction of biotic component with the abiotic components (air, water, soil and land, temp, light), of the Environment with a focus on environmental pollution and degradation.

(b) Environmental Engineering:

- It deals with the study of technical processes involved in the protection of environment from the potentially deleterious effects of human activity and improving the environmental quality for the health and well beings of humans.

(c) Environmental Management:

- It promotes due regard for physical, social and economic environment of the enterprise or projects. It encourages planned investment at the start of the production chain rather than forced investment in cleaning up at the end.
- It generally covers the areas as environment and enterprise objectives, scope, and structure of the environment, interaction of nature, society and the enterprise, environment impact assessment, economics of pollution, prevention, environmental management standards etc.

Scope of environmental studies

Environmental studies discipline has multiple and multilevel scopes

- The study Natural resources their conservation and efficient management.
- It provides the knowledge about ecological systems and Biodiversity
- It provides necessary information about biodiversity richness and the potential dangers to the species of plants, animals and microorganisms in the environment.
- The study enables one to understand the causes and consequences due to natural and main induced disasters (flood, earthquake, landslide, cyclones etc.,).
- Sources of environmental pollutions and control measures
- It enables one to evaluate alternative responses to environmental issues before deciding an alternative course of action.

Scope of environmental studies

- The study enables to know the environmental acts, rights, rules, legislations, etc.) to make appropriate judgments and decisions for the protection and improvement of the earth.
- The study exposes the problems of over population, health, hygiene, etc.
- Social issues in relation to development and Environment
- Research and Development to monitor and controlling technology to solve various environmental issues.
- It teaches the citizens the need for sustainable utilization of resources
- Human population and Environment
- Environmental journalism: To generates awareness among people regarding environmental issues

Through Mass media

- Mass media as news papers, magazines, radios, t v etc., can play an important role in educating the masses regarding environmental problems and issues.
- Through organizing seminars and conferences, organizing meeting seminars, and conferences at various levels help in spreading environmental information to general public.
- Awareness can also be spread by organizing various competitions on environmental problems, non conventional energy sources etc., such competitions may also help in disseminating information regarding various environmental issues.

Importance of Environmental Study

1) Environmental studies helps maintain ecological balance by providing a basic operating knowledge of environmental system and processes.
2) It gives information regarding the changes that takes place due to anthropogenic factors and helps gain skills of analysing various environmental system and the effect of human activities on them.
3) Environmental studies help to achieve sustainable development and understand the relationship between development and the environment.
4) This discipline helps to educate people regarding their duties towards environmental protection.

Importance of Environmental study

5)Environment is one subject that is actually global in nature.

6) Environmental study deals with the analysis of the processes in water, air, land, soil, and organism which leads to pollution (or) environment degradation.

7) It also deals with the most important issues like safe and clean drinking water, hygienic living conditions, clean and fresh air, healthy food for man and for development.

8) The discipline provides us with basic knowledge of the environment and various environmental issues. It examines the scientific basic for environmental and social concerns about our present energy needs, global climate changes, toxic emission and waste disposal.

Importance of Environmental study

9) It also provide knowledge about the development and utilisation of energy resources and the role of public policy there in.

10) Environmental law, business administration and environmental engineering are emerging as new career opportunities for environment protection and management.

Importance of Environmental study

11)Environmental studies also aims to protect bio diversity growth in human population and the resulting increase in material consumption and technological development have increased the rate and scale of degradation of the environment.

12) The concepts from environmental studies can be applied to the study of agriculture and the design of sustainable production system.

13) With the pollution control laws becoming more strengthen, are finding it difficult to dispose off the produced wastes.

Environment and its segments

Environment consists of four segments.

1. Atmosphere: Blanket of gases surrounding the earth.
2. Hydrosphere: Various water bodies present on the earth.
3. Lithosphere: Contains various types of soils and rocks on the earth.
4. Biosphere: Composed of all living organisms and their interactions with the environment.

Atmosphere:

The following points highlight the vital role played by atmosphere in the survival of life in this planet.

- The atmosphere is the protective blanket of gases which is surrounding the earth. It protects the earth from the hostile environment of outer space.
- It absorbs IR radiations emitted by the sun and reemitted from the earth and thus controls the temperature of the earth
- It allows transmission of signicant amounts of radiation only in the regions of 300 { 2500 nm (near UV, Visible, and near IR) and 0.01 { 40 meters (radio waves). i.e it lters tissue damaging UV radiation below 300 nm.
- It acts as a source for CO_2 for plant photosynthesis and O2 for respiration
- It acts as a source for N_2 for nitrogen xing bacteria and ammonia producing plants.

The atmosphere transports water from ocean to land.

Hydrosphere:

- The hydrosphere is a collective term given to all dierent forms of water.
- It includes all types of water resources such as oceans, seas, rivers, lakes,
- streams, reservoirs, glaciers and ground waters.
- It covers more than 75 % of the earth surface.

Lithosphere: The earth is divided in to layers.

- Crust: The crust is the earth's outer skin that is accessible to human.
- The crust consists of rocks and soil of which the latter is the important part of lithosphere.
- Mantle: It is the middle layer of the earth and is made up of dierent types of rocks (Igneous, sedimentary and metamorphic)
- Core: It is the innermost geological layer of the Earth. It is primarily asolid ball of rocks and minerals.
- The lithosphere consists of upper mantle and the crust.
- **Biosphere:**
- The biosphere or ecosphere is a global ecosystem composed of living organisms (biota) and the abiotic (nonliving) factors from which they derive energy and nutrients.
- It extends from 2 kilometres into the atmosphere t

Vertical structure of atmosphere

- Troposphere
- The bottom layer of the atmosphere that stretches about 11 Km
- Contains 75 % of the air
- Temperature decreases with altitude
- Storms and rainfall take place
- Made up of mostly N_2 & O_2

Stratosphere

- The second layer of the atmosphere that extends up to 50km.
- Contains 24 % of the air
- Temperature increases with altitude
- Contains ozone (O_3) layer that protects us from harmful ultraviolet rays

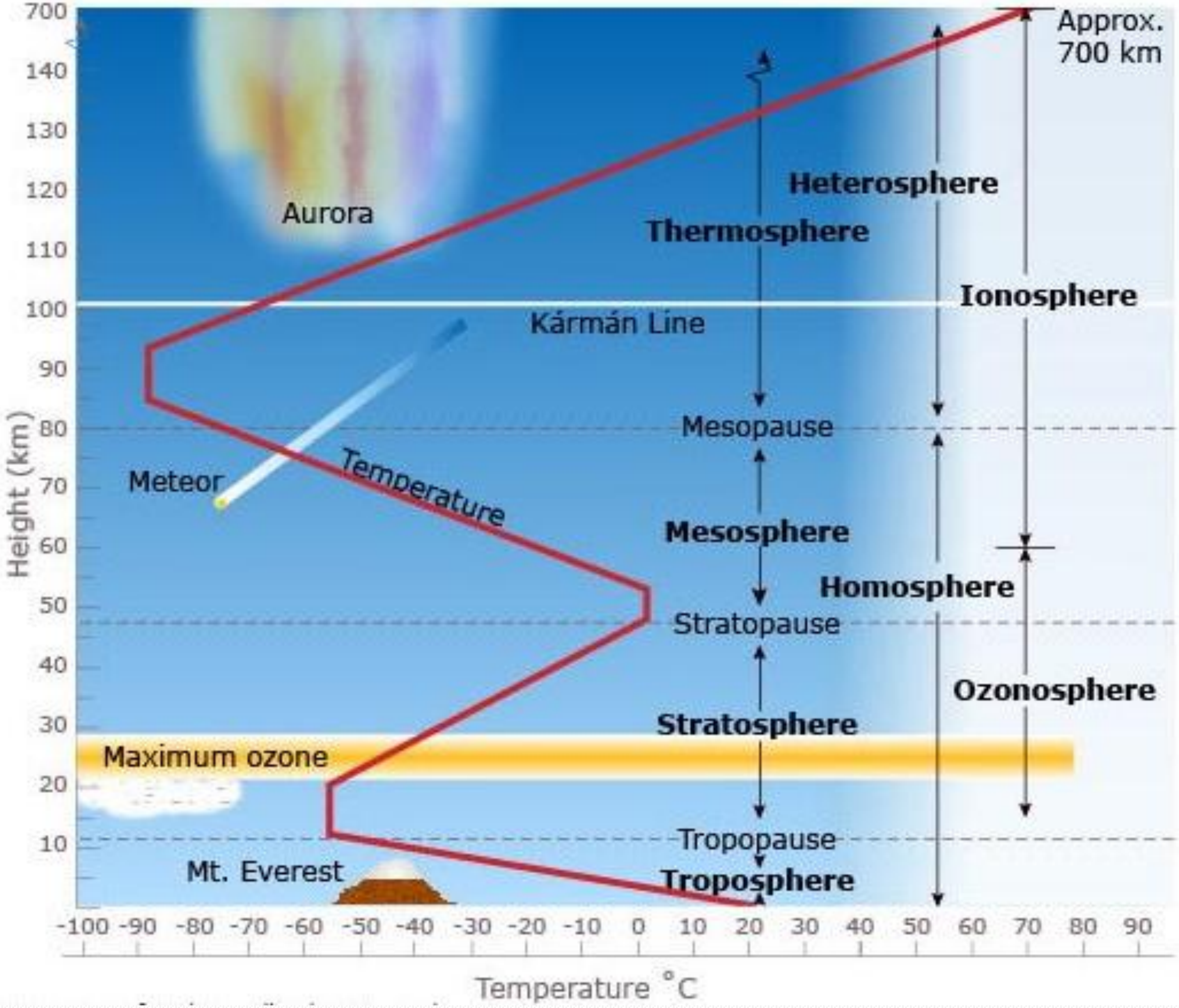
Mesosphere

- The third layer of the atmosphere that extends up to 80 km.
- Temperature decreases with altitude
- The coldest layer
- Here most meteors burn up

Thermosphere (ionosphere and exosphere)

- The fourth layer of the atmosphere that stretches about 1000 km.
- The hottest layer due to the ions (H+ and He□) that directly absorb the sun's radiation
- Temperature increases with altitude
- Where radio waves are reflected.

Vertical structure of atmosphere




Thank you!

(Management Topic in Environmental Studies) B. Tech 7TH Semester

Ecosystem

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Subject: MTES (CHM 2049)

Topic to be discussed

- Introduction
- Types of ecosystem
- Structure of ecosystem
- Function of ecosystem
- Food chain and Food web
- Energy flow in a ecosystem
- Primary production and secondary production
- Ecological Pyramids
- Nutrient flow, Nitrogen cycle, carbon cycle, hydrological cycle

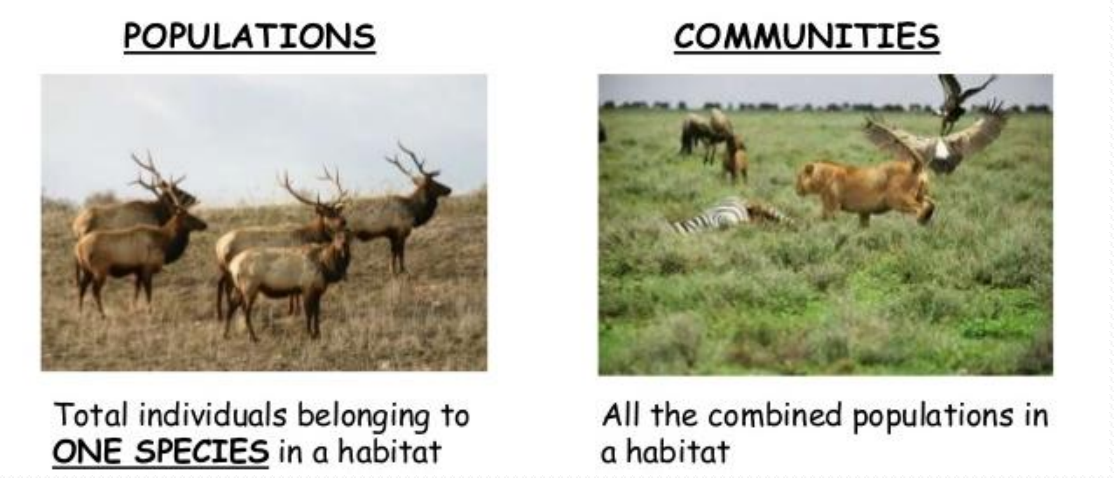
Ecology

- The term Ecology was coined by Earnst Haeckel in 1869.

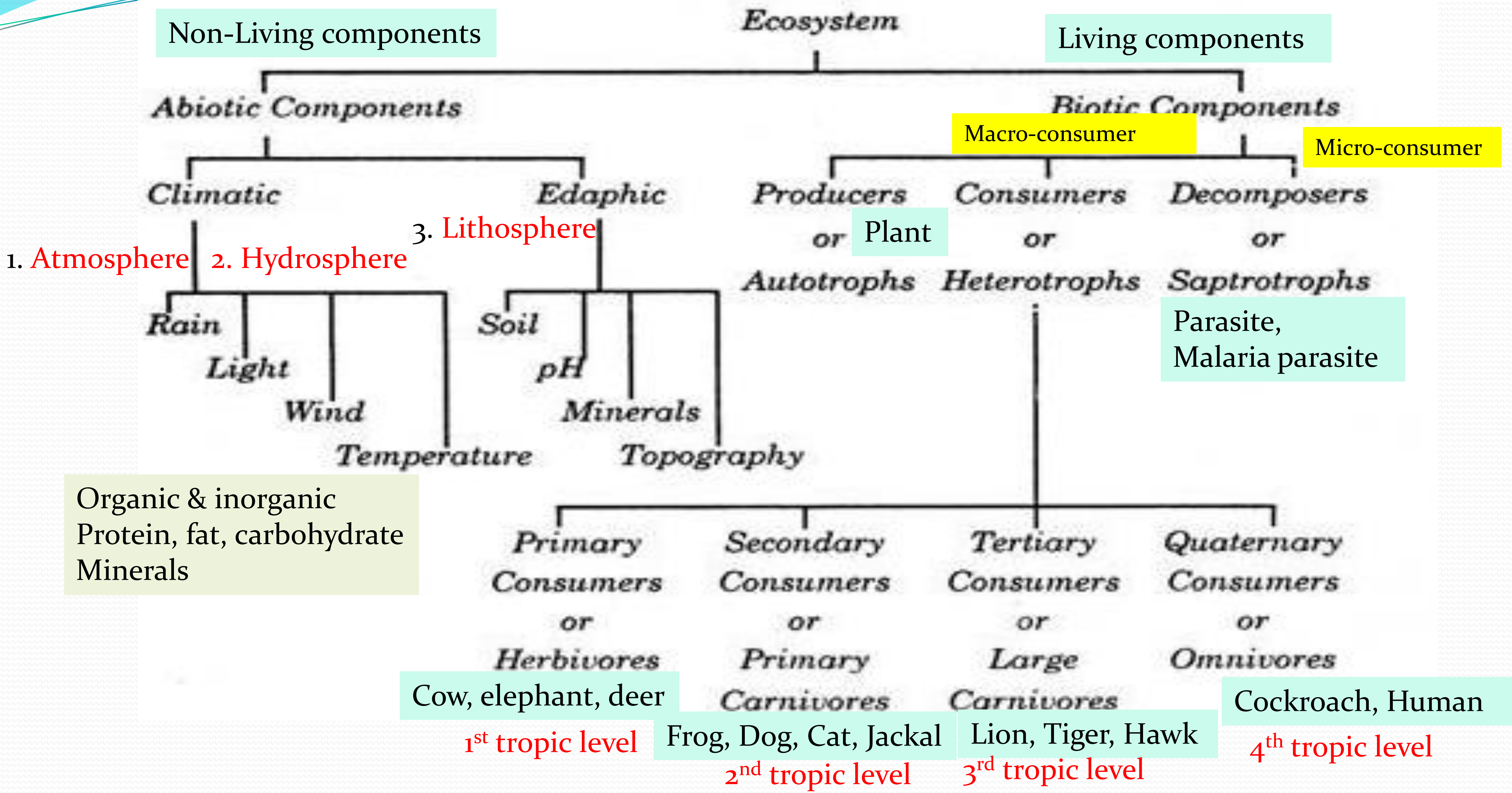
It is derived from the Greek words Oikos- home + logos- study. So ecology deals with the study of organisms in their natural home and interacting with their surroundings

According to Tansley (1935): An ecosystem is a group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter.

Ecology is the study of interactions among organism or group of organisms with their environment. The environment consists of both biotic components (living organisms) and abiotic components (non – living organisms). or Ecology is the study of ecosystems.



Structure of Ecosystem



Types of Ecosystem

- **Ecosystem**
  - **Natural Ecosystem**
    - **Basis-Habitat**
      - **Terrestrial Ecosystem**
        1. Forest Ecosystem
        2. Grassland Ecosystem
        3. Desert Ecosystem
      - **Aquatic Ecosystem**
        - **Types of Water**
          - **Fresh Water Ecosystem**
            - **Nature of Water**
              - **Running Water (Lotic)**
                1. Spring Ecosystem
                2. River Ecosystem
                3. Canal (Nullah) Ecosystem
              - **Stagnant Water (Lentic)**
                1. Lake Ecosystem
                2. Pond Ecosystem
                3. Puddle (Pokhar) Ecosystem
          - **Marine Ecosystem**
            - (i) Ocean ecosystem
            - (ii) Sea Ecosystem
            - (iii) Estuaries Ecosystem
  - **Artificial Ecosystem**
    - **Examples :** (i) Garden (ii) Crop (iii) Aquarium (iv) Farmland

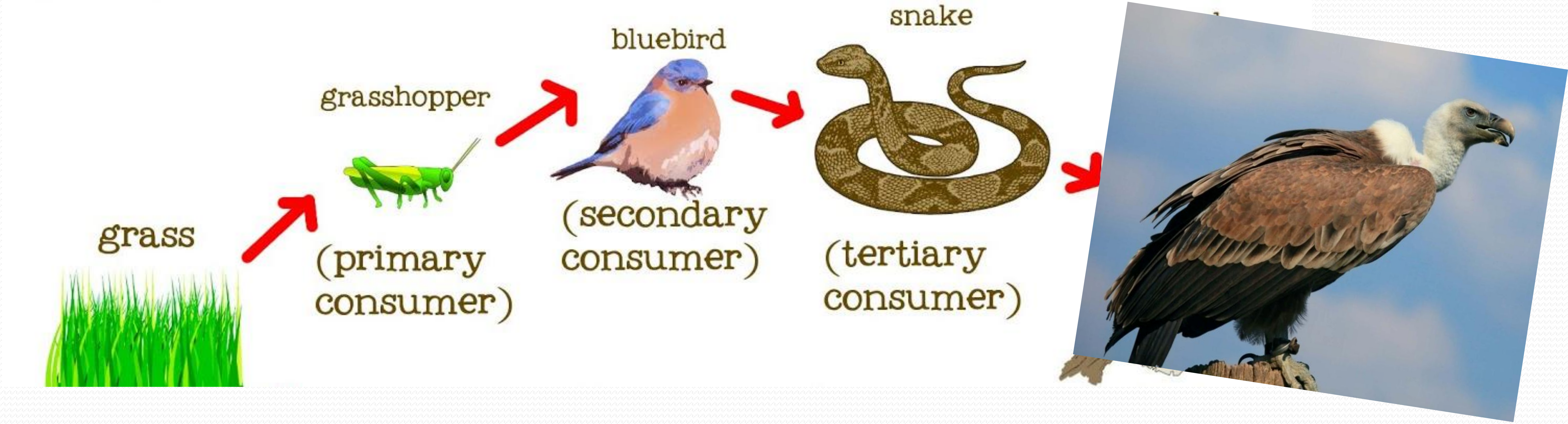
Function of Ecosystem

The major functional of ecosystems are as follows:

- (i)Primary function: Photosynthesis
- ii) Secondary function: Transfer of energy (Energy flow) to all consumer
- Iii) Tertiary function: Food chain, food webs and trophic structure
- (ii) Nutrients flow (Biogeochemical cycles)
- (iii) Primary and Secondary production
- (iv) Ecosystem development and regulation
- (v) Control species gradient
- (vi) Pollution control such as CO_2 by plant, Nitrogen fixation by *Rhizobium* bacteria

Food Chains

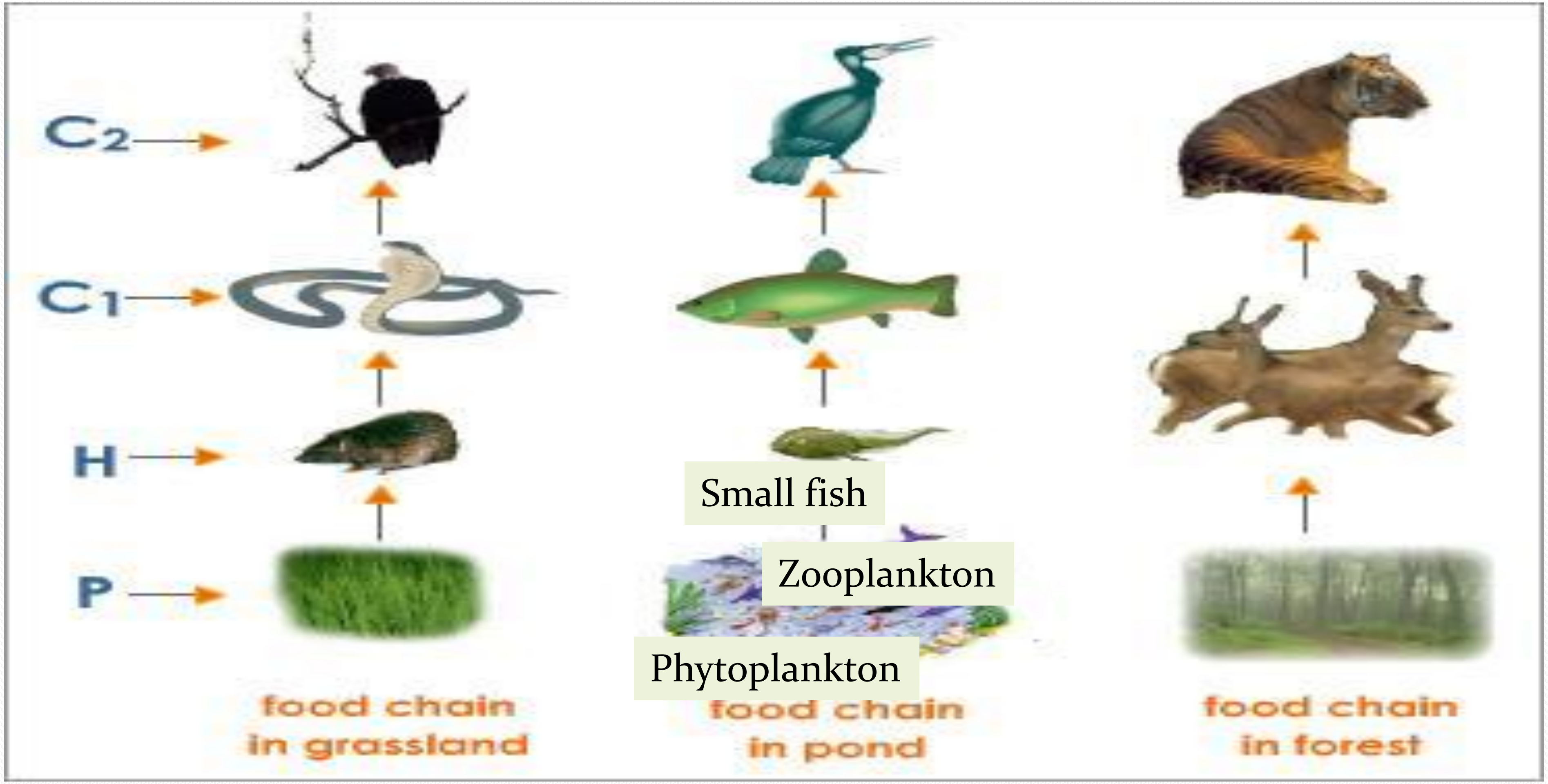
Food chain: Transfer of food energy/ chemical energy from producer/plant to higher successive tropic level by eating and being eaten.



Types of Food Chains

Types of Food Chain

i) **Grazing/ predator food chain**: Food chain Start with grazing or killing as shown in figure



Types of Food Chains

ii) Detritus Food chain: Start with dead and decaying material

iii) Parasitic Food Chain: Parasite is taking food from living host

Plant → Fruit eating bird → Lice and Bug → Bacteria/ Fungi

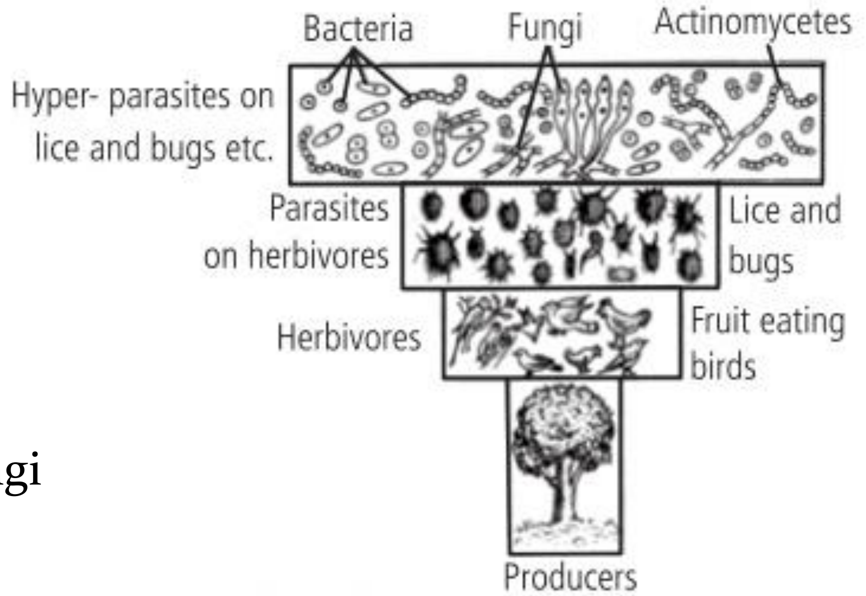
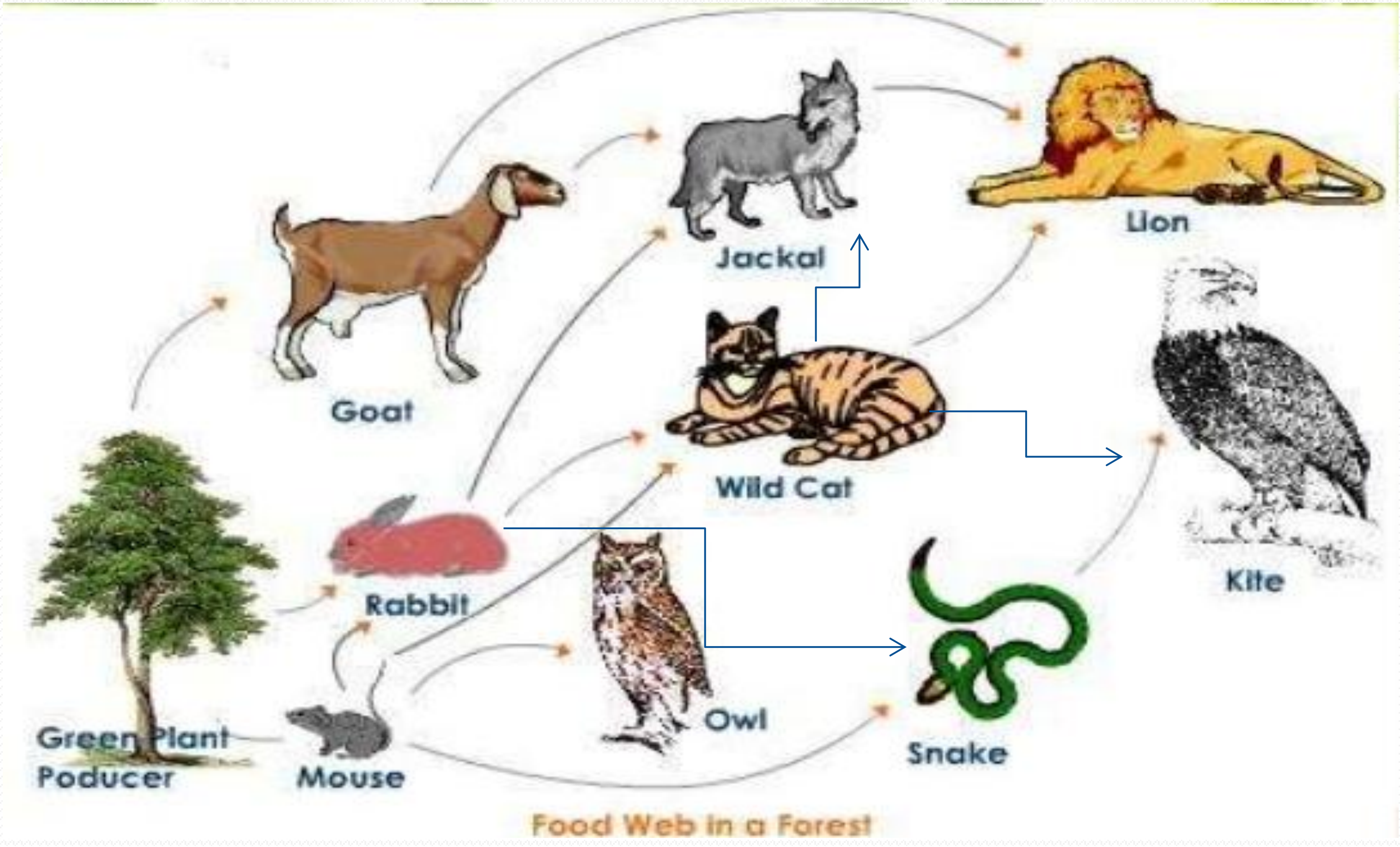
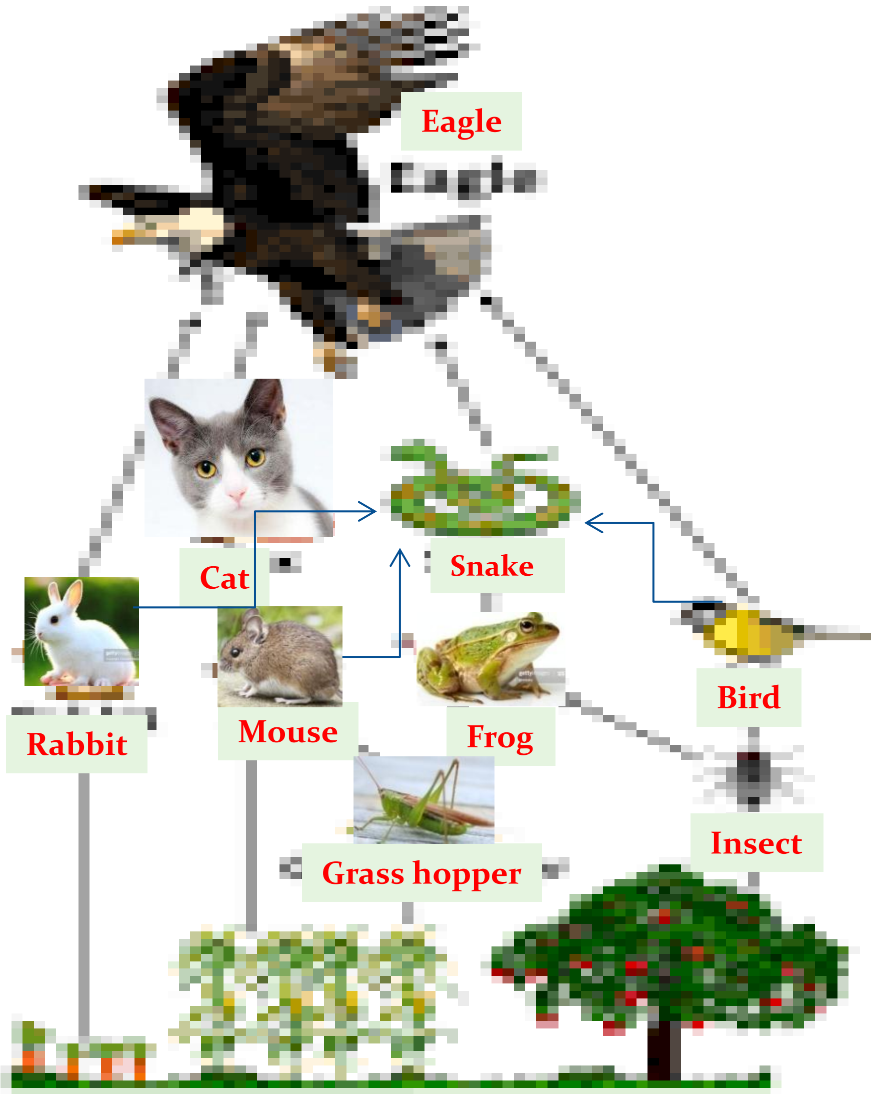


Fig.: Pyramid of numbers in parasitic food chain

Food web

Food web: The interconnection of different types of food chain in a ecosystem by different types of organisms at different tropic levels, forming a web like structure collected Food web. Where different types of organisms are connected at different tropic levels

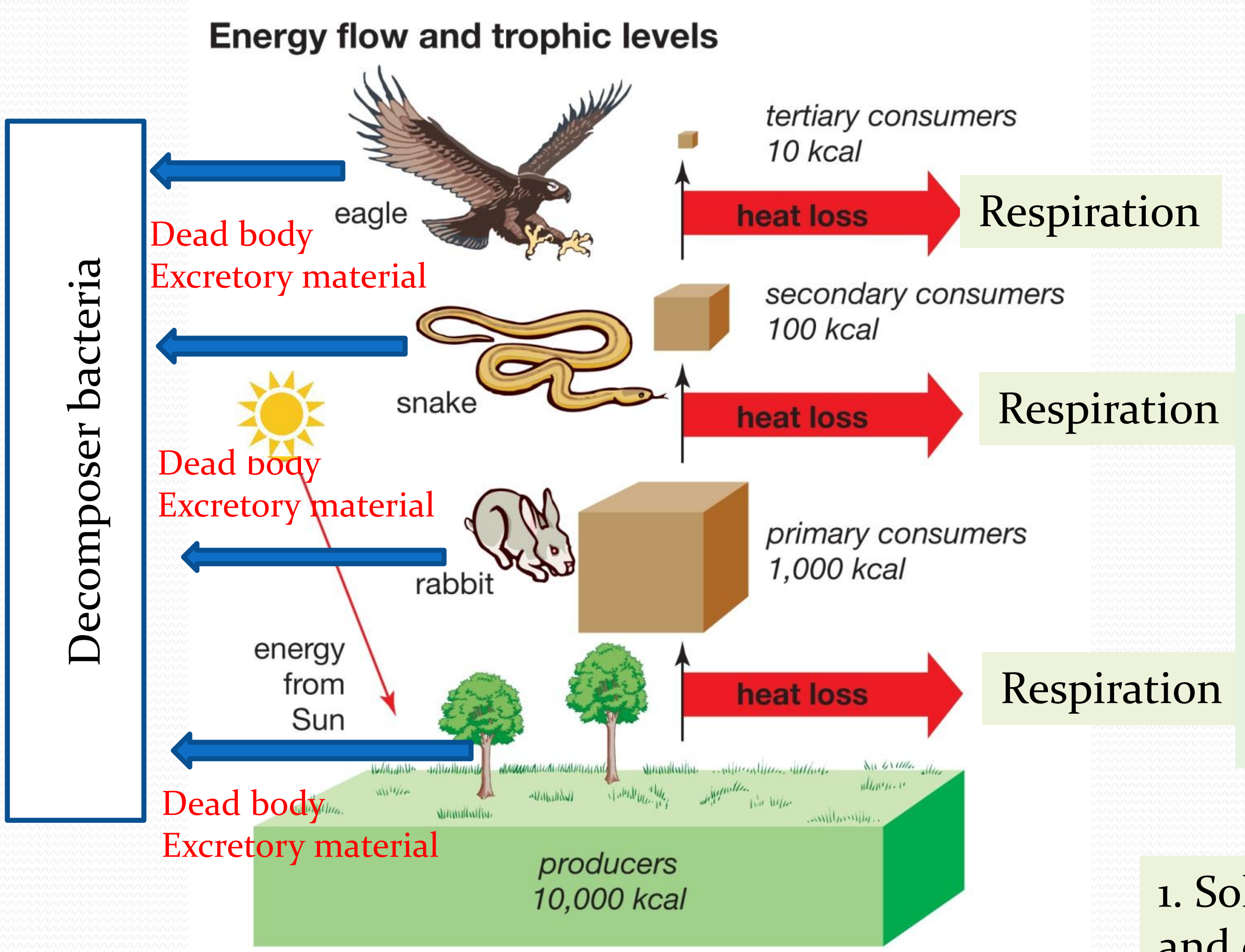




Significant of Food chains and Food webs

1. Food chains and food webs play a very important role in the ecosystem. Energy flow and nutrient
2. cycling takes place through them.
3. They maintain and regulate the population size of different tropic levels, and thus help in maintaining ecological balance.
4. They have the property of bio-magnification. The non – biodegradable materials keep on passing from one tropic level to another. At each successive tropic level, the concentration keep on increasing. This process is known as bio-magnification.

Energy flow in a Ecosystem



Energy flow is unidirectional but nutrient flow is cyclic

4. Some food energy stored in consumer system & plant (excretory Material) move to (flow) decomposer bacteria and stop the flow of energy

3. Some food energy is utilized for metabolism of food material in the consumer system called respiratory Energy

2. Plants biochemical energy (Food energy) consume by primary, 2ndary and tertiary consumer where food energy converted
To mechanical energy, heat energy, sound energy, potential energy etc energy
Follow 2nd low of thermodynamic
Each step 90% energy loss in the form of heat, sound, respiration energy

1. Solar radiation energy trap by plant and in photosynthesis and converted to biochemical energy (Food energy)
Follow 1st low of thermodynamic

Energy Flow

Energy is the most essential requirement for all living organism. Solar energy is the only source to our planet earth. Solar energy is transformed to chemical energy in photosynthesis by the plants (called as primary producers). Though a lot of sunlight falls on the green plants, only 1% of it is utilized for photosynthesis. This is the most essential step to provide energy for all other living organisms in the ecosystem.

Some amount of chemical energy is used by the plants for their growth and the remaining is transferred to consumers by the process of eating.

Thus the energy enters the ecosystems through photosynthesis and passes through the different tropic levels feeding levels.

Primary production

- Primary productivity: The rate at which radiant energy (light energy) is converted into chemical energy and stored in a plant by photosynthesis process per unit area per unit time called Gross Primary Production (GPP)
- Respiration energy: When organic matter is produced by the primary producers (mainly green plants and some microorganisms), fraction of chemical energy is oxidized or used in the metabolic process of photosynthesis inside their body and converted into carbon-dioxide which is released during respiration called respiration energy and is accompanied by loss of energy. (R)
- Thus Net Primary Production (NPP) = Gross Primary Production (GPP) – Respiratory energy (R).

NPP = GPP -R

Secondary Production: The energy stored at consumer level for use by the next trophic level is thus defined as secondary production

Ecological Pyramids

Definition

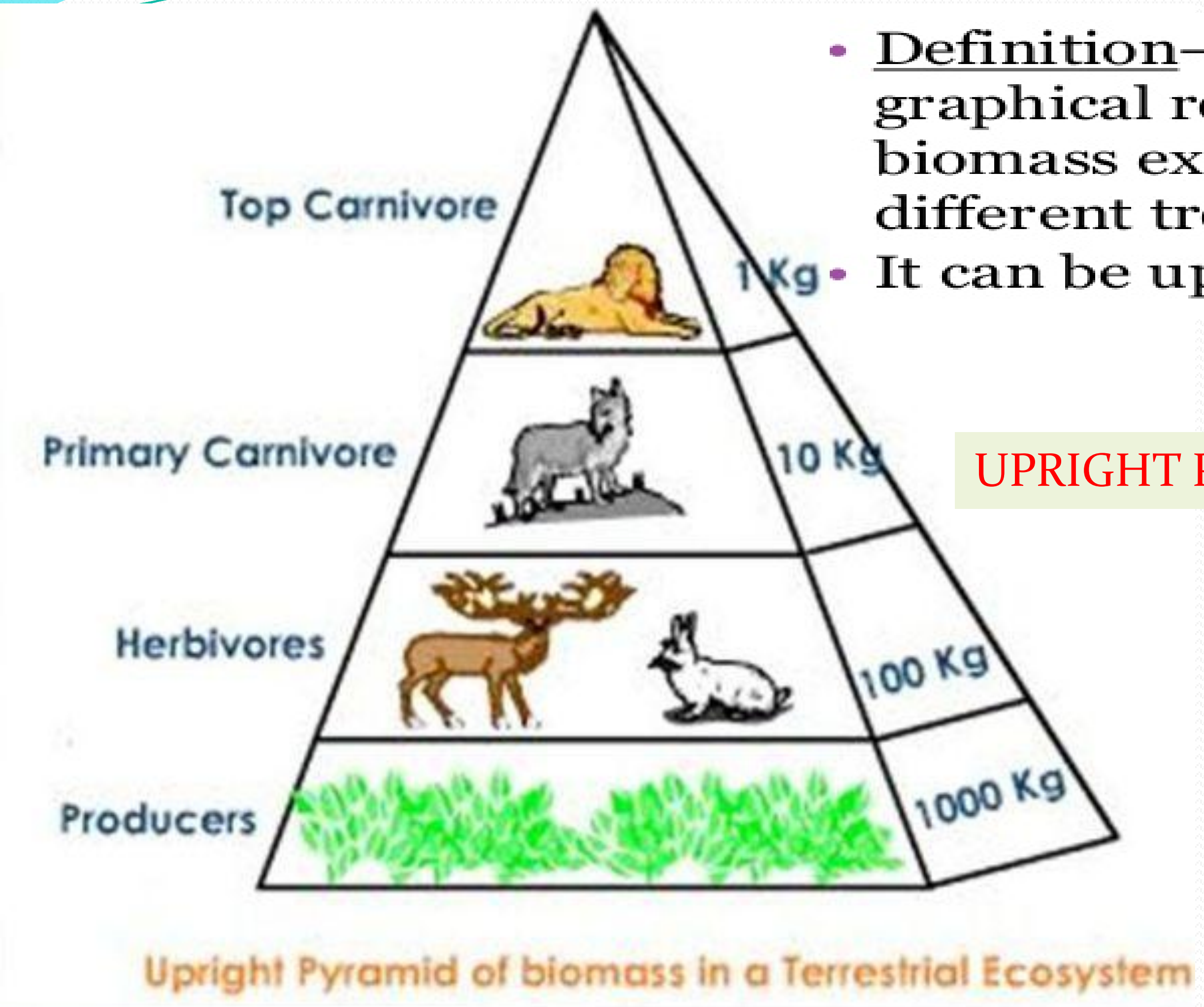
"Graphical representation of structure and function of tropic levels of an ecosystem, starting with producers at the bottom and each successive tropic levels forming the apex is known as an ecological pyramids."

In food chain starting from the producers to the consumers, there is a regular decrease in the properties (ie.,, biomass and number of the organisms). Since some energy is lost as heat in each tropic levels, it becomes progressively smaller near the top.

Types of Ecological pyramids

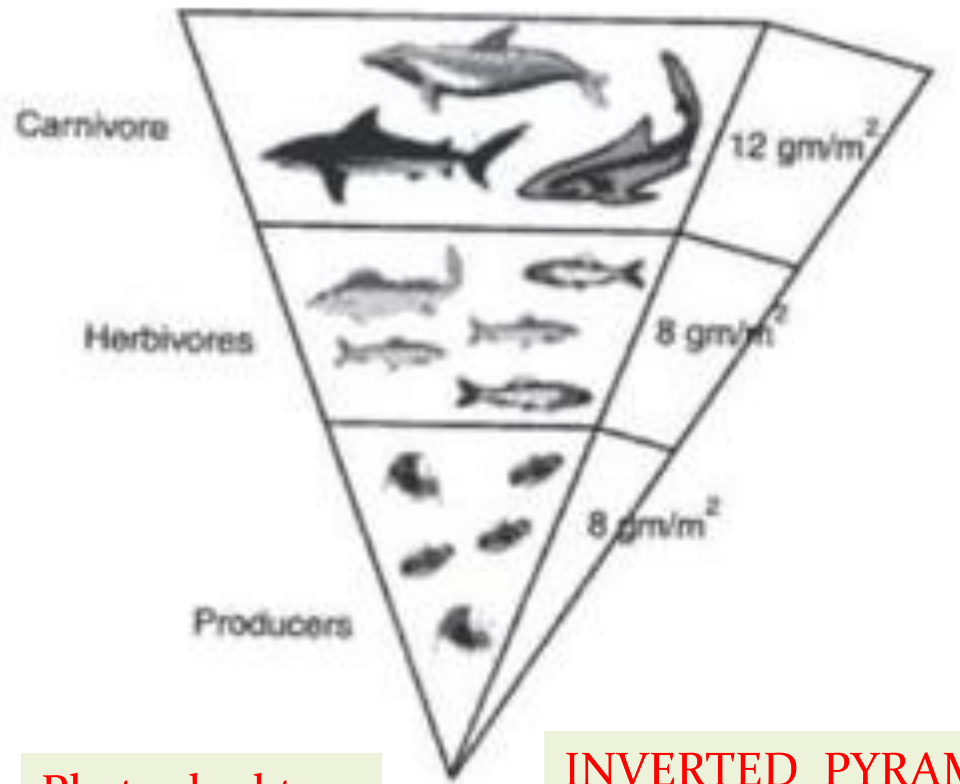
1. Pyramid of numbers.
2. Pyramid of energy.
3. Pyramid of biomass.

Pyramids of Biomass



- Definition– The pyramid of biomass is a graphical representation that depicts the biomass existent in per unit area in all the different trophic level of the ecological system.
- It can be upright and inverted.

UPRIGHT PYRAMID



A pyramid of biomass shows the weight of biomass/organism
At stages of food chain

Phytoplankton

INVERTED PYRAMID

A pyramid of biomass in aquatic system

Pyramid of Biomass

It represents the total amount of biomass (mass o weight biological material or organism) present in each tropic levels.

A forest ecosystem

The above figure shows that there is a decrease in the biomass from the lower tropic level to the higher tropic level. This because the trees (producers) are maximum in the forest, which contribute a huge biomass. The next tropic levels are herbivores (insects, birds) and carnivores (snakes, foxes). top of the tropic level contains few tertiary

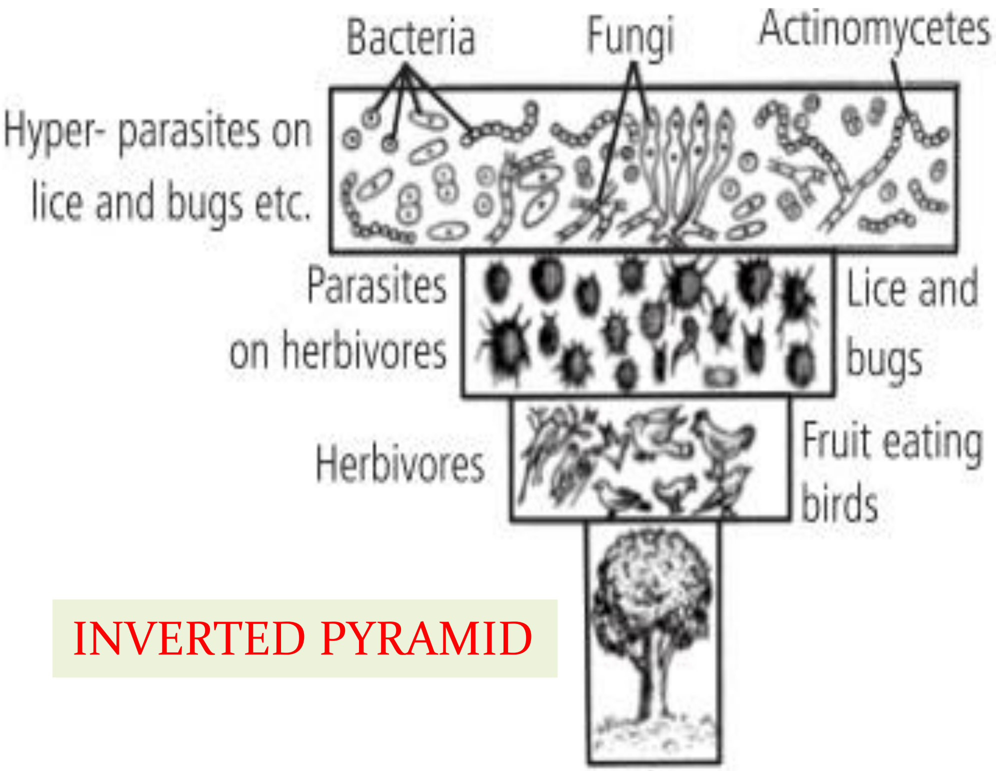
consumers S and tigers), the biomass of which is very low.

Pyramid of Number

<u>Definition</u>– the number of organisms in a food chain can be represented graphically in a pyramid. Each bar represents the number of individuals at each trophic level in the food chain.

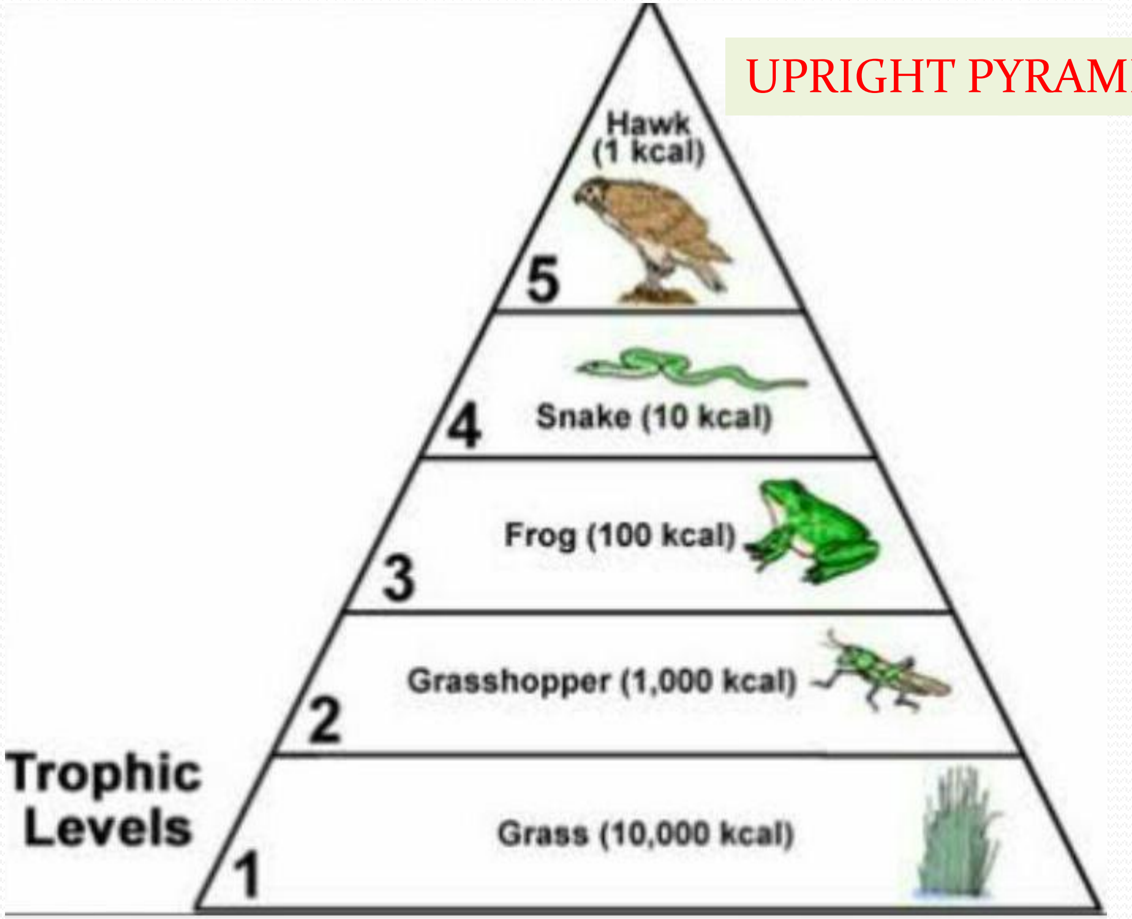
It can be upright and inverted.

A pyramid of numbers can be used to show the number of organisms at each stage of a food chain.



INVERTED PYRAMID

Fig.: Pyramid of numbers in parasitic food chain

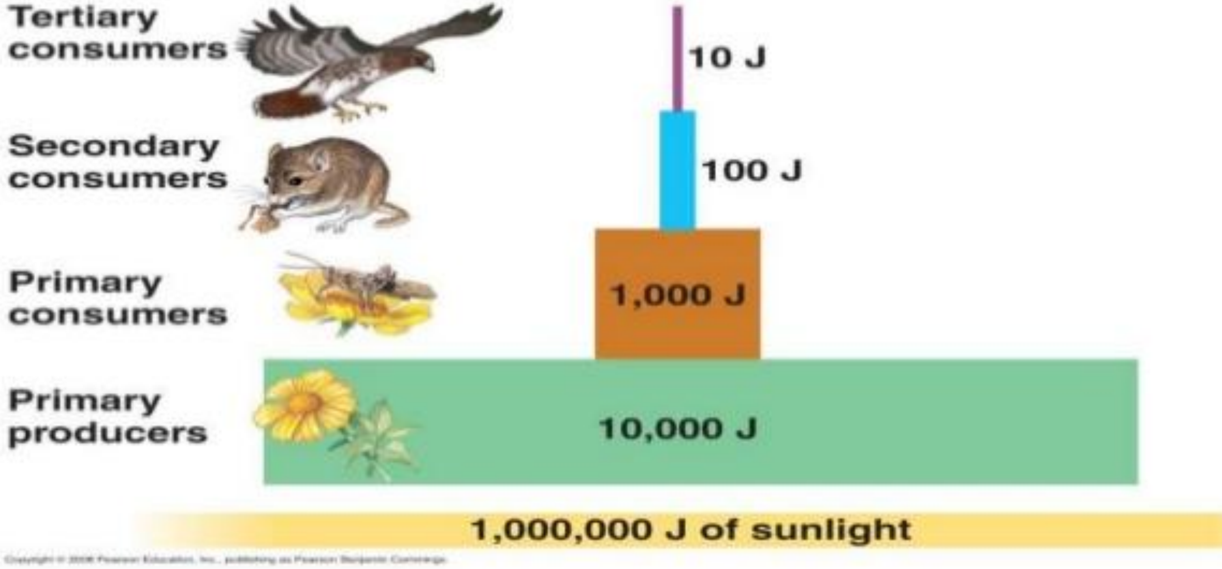


UPRIGHT PYRAMID

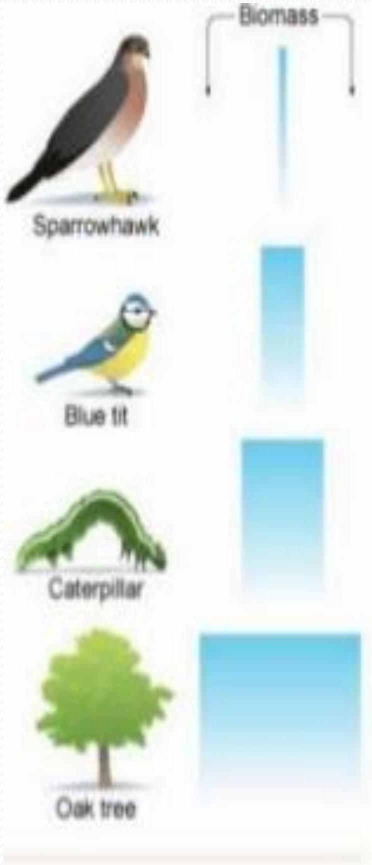
- Pyramid of Number in grass land ecosystem

Pyramid of Energy

- Definition- An energy pyramid is a graphical model of energy flow in a community. The different level represent different group of organism that might composed of food chain.
- Pyramid of energy is always upright as it follows the second law of thermodynamics which states that as energy is transferred or transformed, more and more of it Transferred to other form



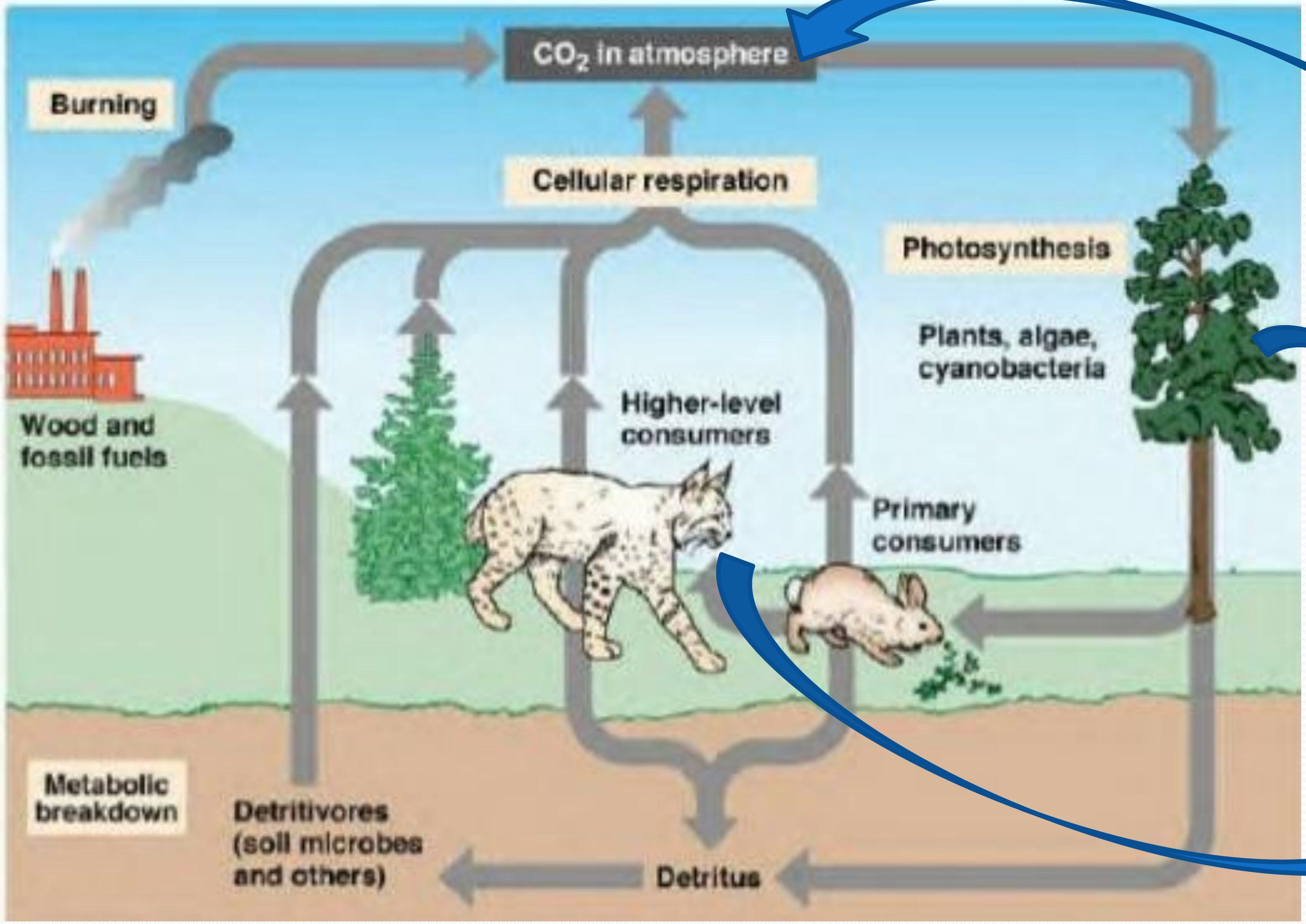
- Only 10% of the energy is available to next trophic level (as per Lindemann's ten percent rule)
- The energy level of each trophic level has two arts i.e. Net Production (NP) and Respiration (R) and measured in KJ m^{-2} yr^{-1}



- Energy moves from one trophic level to the next.
- So energy moves from oak tree to caterpillars.
- Energy is lost at each stage due to it being lost to the environment by
  - respiration (heat energy)
  - faeces (poo)

Carbon cycle

Cyclic movement of carbon from biosphere through lithosphere, hydrosphere and atmosphere called carbon cycle

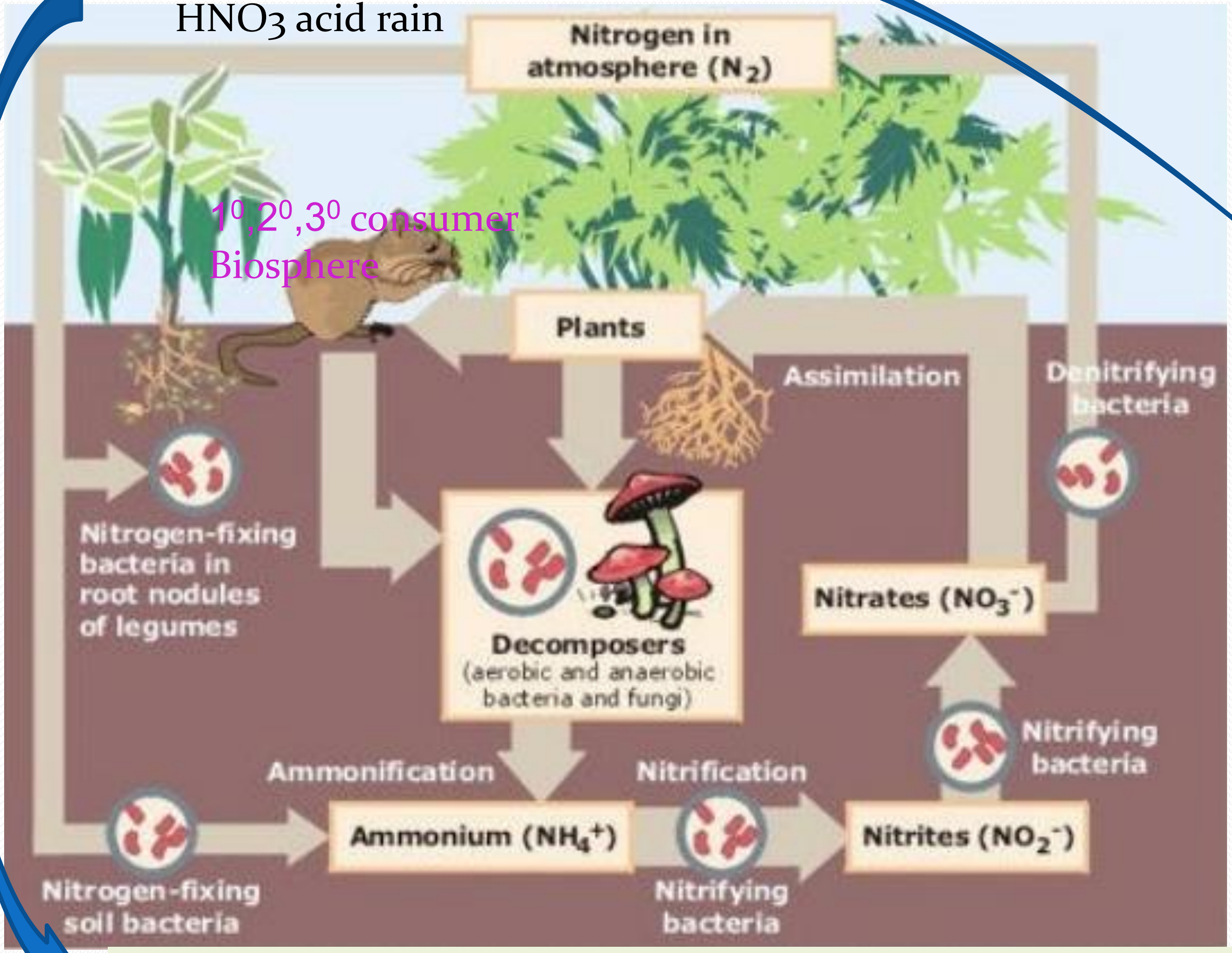


CO_2

Natural calamity
earth quake
Buried deep in to earth with high temp, & pressure formed Coal , petrol and diesel etc

Nitrogen cycle

HNO3 acid rain



$1^0,2^0,3^0$ consumer
Biosphere

- Nitrogen fixation- nitrogen gas in atmosphere to ammonia (bacteria in soil, lightning)
- Nitrification- ammonia to nitrate (bacteria in soil)
- Assimilation- absorption of ammonia and nitrate by plants
- Ammonification- break down of dead organisms returns nitrogen to soil (bacteria and fungi) as ammonia.
- Denitrification- conversion of ammonia back to nitrogen gas (decomposers).

NOx

Fossil fuel etc

Lithosphere, hydrosphere, Biosphere, Industrial Nitrogen fixation

Hydrological cycle

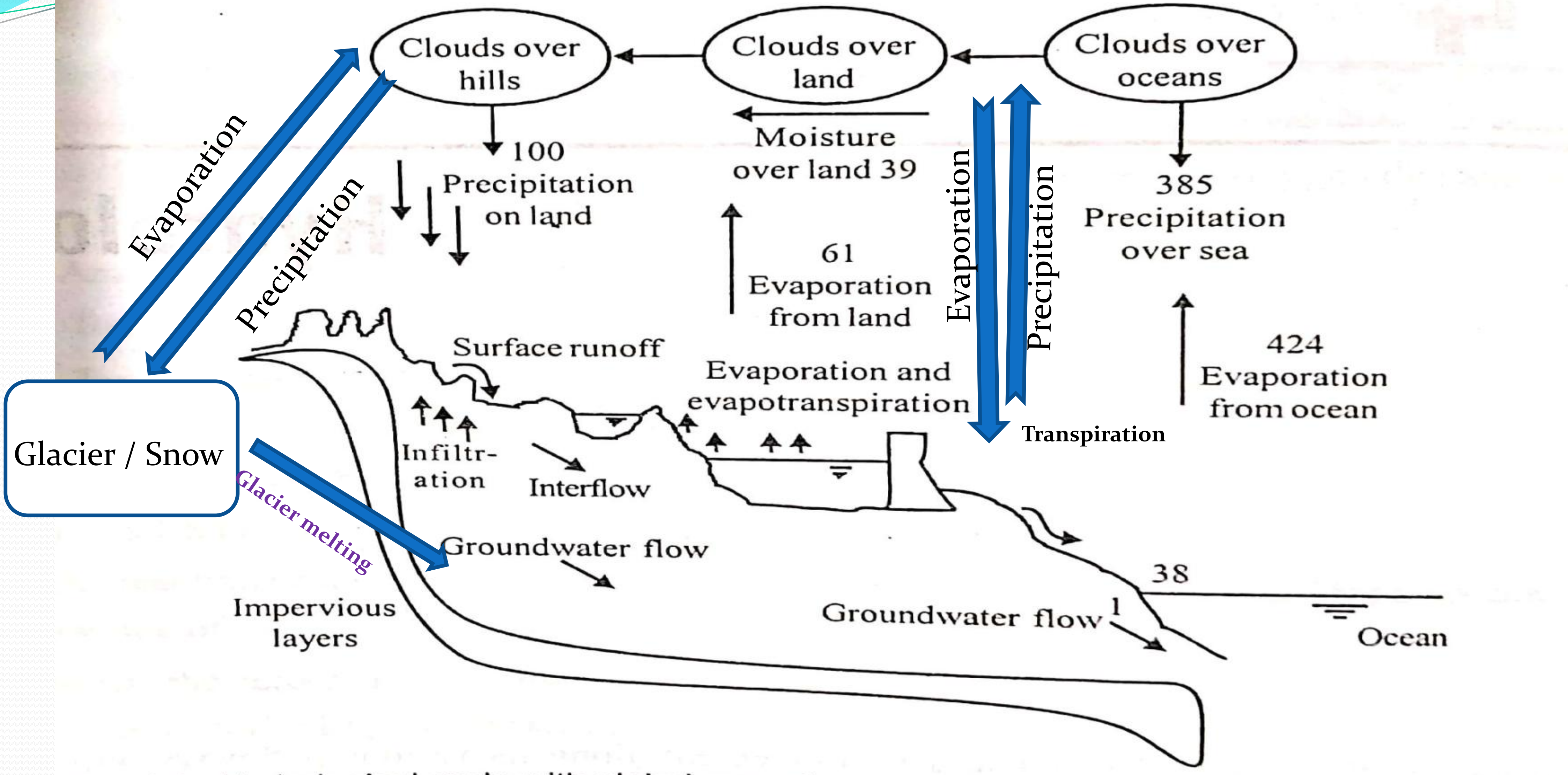


Fig. 4.1 Hydrological cycle with global annual average water balance given in units relative to a value of 100 for the rate of precipitation on land.


Thank you!

(Management Topic in Environmental Studies) B. Tech 7^{TH} Semester

Ecological succession

Ecosystem

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Subject: MTES (CHM2049)

Contents

- Introduction to Ecological succession
- Type of Ecological Succession
- General Process of Ecological Succession
- Primary Succession
- Secondary Succession
- Difference between primary and secondary succession
- Physical factors involving in ecological succession
- Threats to Climax Communities

Definition:

- **Ecological succession**: is defined as an orderly process of changes in the community structure and function with time mediated through modifications in the physical environment (climate) and ultimately culminating in a stabilized ecosystem known as climax.

- The gradual replacement of one plant community by another through natural processes over time

Classification based on different types of areas

- Ecological successions starting on different types of areas or substrata are named differently as follows:
- (i) Hydrarch or Hydrosere: Starting in watery area like pond, swamp, bog
- (ii) Mesarch: starting in an area of adequate moisture.
- (iii) Xerarch or Xerosere: Starting in a dry area with little moisture.
- Lithosere : starting on a bare rock
- Psammosere : starting on sand
- Halosere : starting on saline soil

Process of Succession

- Sequential steps of Ecological succession :
- **(i) Nudation:** Start from bare area/land without any life form.
- The bare area may be caused due to landslides, volcanic eruption , drought, glaciers etc. overgrazing, disease outbreak, agricultural/industrial activities.
- **(ii) Invasion:** It is the successful establishment of one or more

  species on a bare area due to dispersal of the seeds, spores by wind, water, insects or birds. Then the seeds germinate and grow on the land as pioneer species.



Process of Succession

- **iii) Competition and Co-action:** As the number of individuals grows there is competition for space, water and nutrition. both inter-specific (between different species) and intra-specific (within the same species),
- They influence each other in a number of ways, known as co-action
- **(iv) Reaction:** The living organisms grow, use water and nutrients from the substratum, and in turn, they have a strong influence and modified the environment known as reaction.
- The modifications are very often unsuitable for the existing species and favour some new species.
- **(v) Stabilization:** The succession ultimately culminates in a more or less stable community called climax

The climax community is characterized by maximum biomass and symbiotic relationship

There are two main types of Ecological Succession

Primary Succession: The process of creating life in an area where no life previously existed.
Volcano, Rock, Desert, drought, glaciers

Secondary Succession:
The process of re-stabilization/ re-growth after a disturbance in an area with existing soil where life has formed again an ecosystem. Example Corn field

Primary Succession

- **The development of an ecosystem in an area in which a community has never lived before, would be a new lava or rock from a volcano that makes a new island.**

No soil, there is no Nutrient and community

Primary Succession

Lichens begin growing on the rocks. Over many years lichens produce acid and break down rock into sand.
Weathering and erosion break down rock into sand.

Lichens that do not need soil and grow in dry condition to survive Called **PIONEER SPECIES**

Primary Succession

Lichens grow larger. And death decompose of lichen increases the organic content of the sand with organic content. Nitrogen cycle begins. Eventually enough nutrients enter the sand and it becomes soil.

Seeds are blown in by the wind or carried in by animals. Simple plants like **mosses** can grow in the new soil The plants grow and the soil gets enriched as plants die.

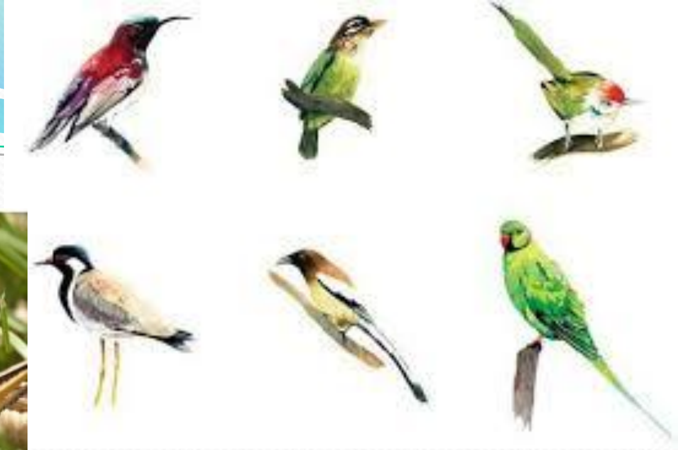
Primary Succession

Mosses and fern
can grow on new soil

- Fern, Herbs and weeds can grow in the thicker, enriched soil

The herbs and weeds plants die, adding more organic material. The soil layer thickens, and grasses, wildflowers, and other plants begin to take over

Primary Succession



- Insects and small birds make this their habitat.

- The vegetation grows closer together, reducing the amount of space available for growing.
- Competition between lichen and shrubs for the same space.

Eventually one species (lichen) will die out (or move) and the other species will survive (shrubs).

Primary Succession

- These plants die, and they add more nutrients to the soil
- Shrubs and tress can survive now

Mammals have begun to move in
What was once bare rock now supports a variety of life

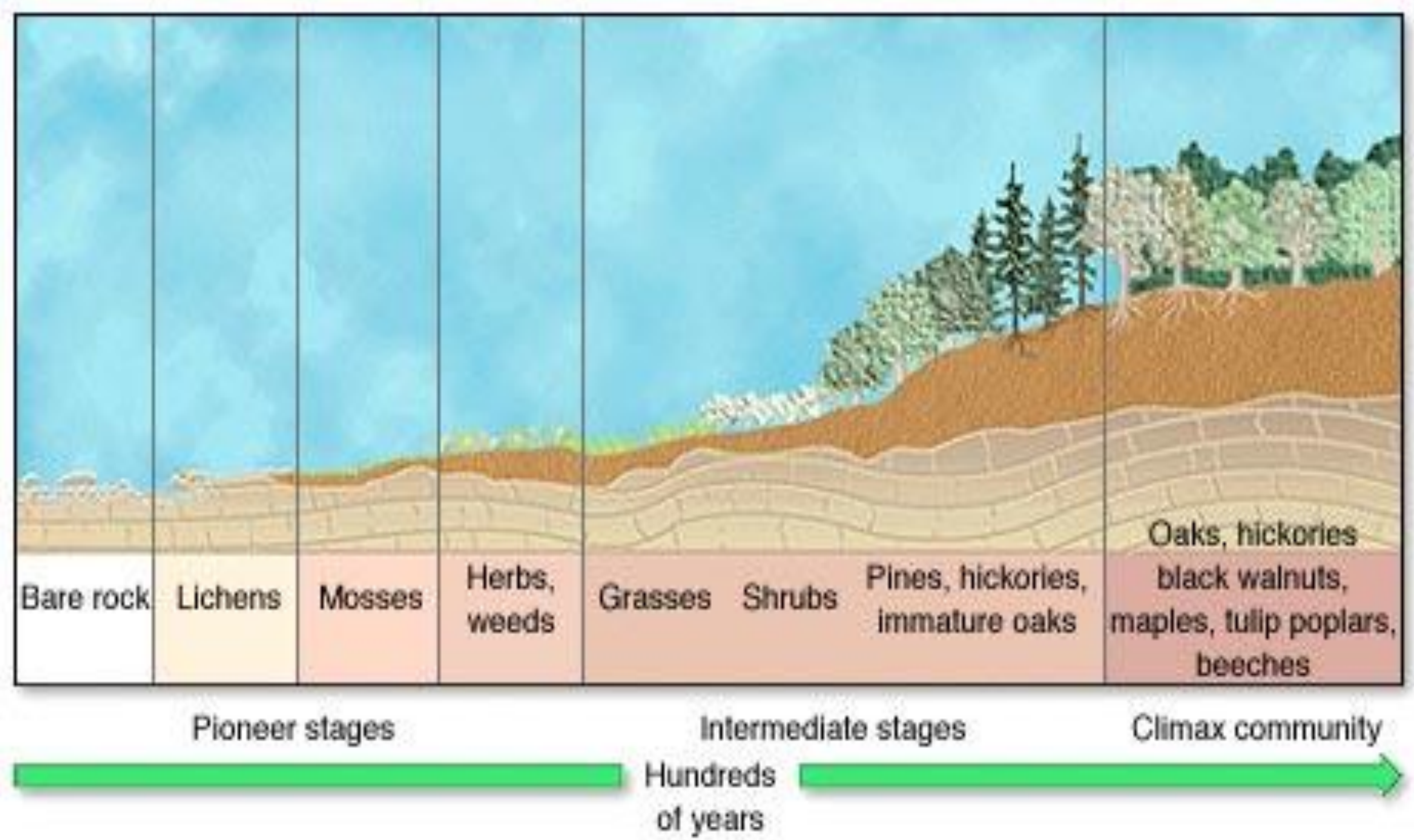
Primary Succession

- These plants die, and they add more nutrients to the soil
- Now larger trees can grow: Beech, Oak, Walnut, Maple…

The Climax Community

A climax community is a mature, stable and best adapted community that is the final stage of ecological succession.

Primary Succession



Secondary Succession

- Organisms are destroyed but the soil is safe.
- The soil already contains the seeds of weeds, grasses, and trees. More seeds are carried to the area by wind and birds.
- Succession begins again but the primary species are different.
- Because soil is present, this succession is faster.

Secondary Succession on an abandoned Cornfield

a.

b.

c.

d.

e.

Figure 24.18 Secondary succession from a cornfield. a. During the first year, only the remains of corn plants are seen. b. During the second year, wild grasses have invaded the area. c. By the fifth year, the grasses look more mature and sedges have joined them. d. During the tenth year, there are goldenrod plants, shrubs (blackberry), and Eastern juniper trees. e. After twenty years, the juniper trees are mature and there are also birch and maple trees in addition to the blackberry shrubs.

Difference between primary and secondary succession

Primary Succession	Secondary Succession
Begins with no life	Follows removal of existing biota
No soil present	Soil already present
New area (e.g. volcanic island)	Old area (e.g. following a bush fire)
Lichen and moss come first	Seeds and roots already present
Biomass is low	Biomass is higher

Physical factors involving in ecological succession

The **factors** involved in **ecological succession** are either biotic or abiotic.

Abiotic factors.

i) Light. Sun Light affects living things in terms of intensity, quality and duration.

ii) Temperature.

iii) Atmospheric Pressure.

iv) Humidity.

v) Rain fall pattern

vi) Soil quality, moisture and organic content, its pH

vii) Wind flow

Humidity affects the rate at which water evaporates from the surface of organisms such as in transpiration or sweating.

Wind. etc.,

Threats to Climax Communities

- Rapid urbanization and roads, railway tract
- Mainlining activities
- Industrial establishment
- Demand of Wild life product and fuel
- Deforestation for agricultural purposes
- Construction of big Dams
- Pest and wide spread diseases
- Flooding and Volcanic eruptions
- Forest Fires
- Anything that destroys the existing community,


Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU


MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS

(Management Topic in Environmental Studies)
B. Tech 7TH Semester

BIODIVERSITY (PART-1)

Department: Chemistry
Subject: MTES (CHM2049)

Contents

- What is Biodiversity
- Types of Biodiversity
- Values of Biodiversity
- Global Biodiversity
- Biodiversity in India
- Hot spot Biodiversity

What is Biodiversity

- The term Biodiversity was first coined by Walter G. Rosen in 1986.
- The word Biodiversity originates from the Greek word BIOS = LIFE and Latin word DIVERSITAS = VARIETY or DIFFERENCE.
- The whole word BIO DIVERSITY generally therefore means: VARIETY OF LIFE.
- Biodiversity is the degree of variation of life. It is a measure of the variety of organisms present in different ecosystems.

Biodiversity: It is concerned with the variety of individuals within populations, the diversity of species within communities, and the range of ecological roles within ecosystems

Types of Biodiversity

1) Species biodiversity, 2) Genetic biodiversity, 3) Ecosystem biodiversity

1. Species Biodiversity:

i) Refers to the variety of species within a community in a region.

ii) It an index represents species richness and their abundance in a community.

ii) At present, about 1.8 million species on Earth.

iii) India is among the world's 15 Nations that are exceptionally rich in species diversity.

It is the variety of different species in a given area/Communities

Types of Biodiversity

2. *Genetic Biodiversity*: **It may be defined as variability in genes of a particular species in a population**

Recombination of gene (DNA) gives rise to some new variety

Each member of any plant and animals species differ from others due to genetic recombination.

All rice, dog, insect varieties, on colour, size , shape etc

Today the new varieties created By genetically **manipulation** of DNA

i) Disease resistant, Drought resistance crops

ii) Breed superior domestic animals (high yield Caws, plants)

iii) Better medicines and a variety of industrial products are also developed.

Types of Biodiversity

(3) Ecosystem Biodiversity:

Ecosystem: Integration of biotic and abiotic components of a particular environment and their interaction with each other

i) This is the diversity of ecological complexity showing variations in ecological tropic structure, food chain food-webs, nutrient cycling resulted different variety of Ecosystem.

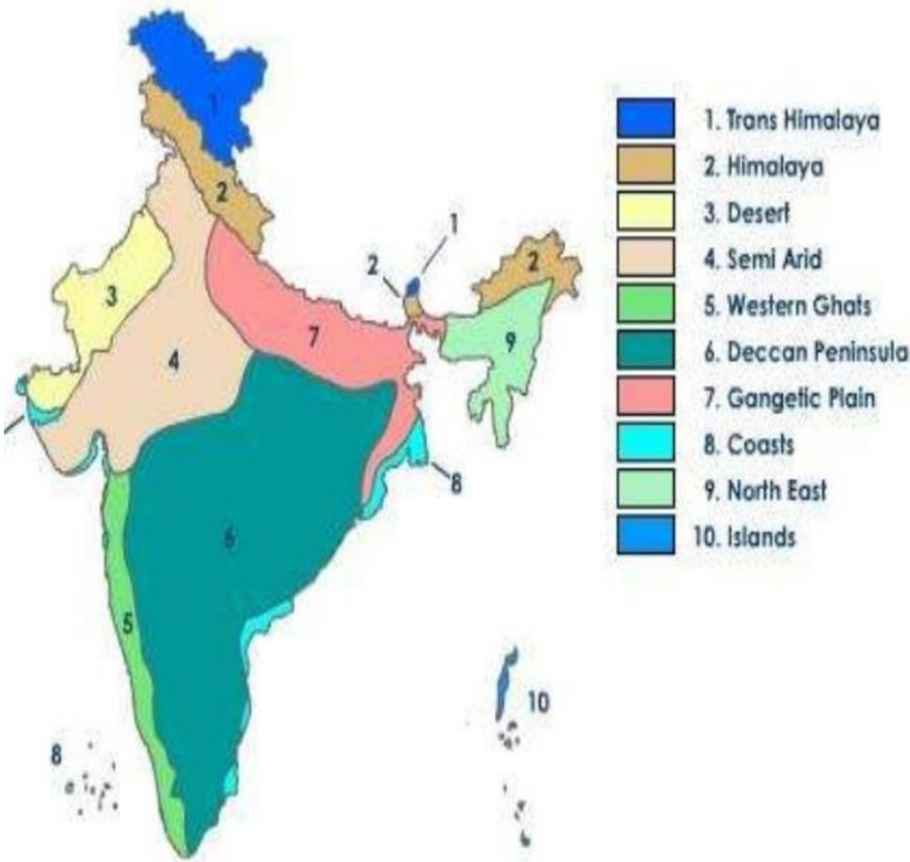
ii) variations is caused by change in physical parameters like hydrosphere, atmosphere, and lithosphere, moisture, temperature, altitude, precipitation etc.

E.g. Forest, Grassland, Desert, Pond ecosystems.

Biogeographic Classification of India

Sr. No.	Biogeographic Zone	Biotic Province	Total area (Sq. Km.)
1.	Trans-Himalayan	Upper Regions	186200
2.	Himalayan	North-West Himalayas West Himalayas Central Himalayas East Himalayas	6900 720000 123000 83000
3.	Desert	Kutch Thar Ladakh	45000 180000 NA
4.	Semi-Arid	Central India Gujarat-Rajwara	107600 400400
5.	Western Ghats	Malabar Coast Western Ghat Mountains	59700 99300
6.	Deccan Peninsula	Deccan Plateau South Central Plateau Eastern Plateau Chhota Nagpur Central Highlands	378000 341000 198000 217000 287000
7.	Gangetic Plain	Upper Gangetic Plain Lower Gangetic Plain	206400 153000
8	Coast	East coast and waste coast	6500 6500
9	North-East India	Brahmaputra Valley North-Eastern Hills	65200 106200
10	Islands	Andaman Islands Nicobar Islands Lakshadweep Islands	6397 1930 180

India is divided in to 10 major regions based on geography, climate, vegetation pattern, mammals, birds, reptiles, amphibians, insects and other invertebrates present in them.



Source: .Conserving our Biological Wealth., WWF for Nature-India and Zoological Survey of India.

Values of Biodiversity

1. Direct values (Consumptive uses)

- Food, fuel, medicines for local community –forest ecosystem.
- Food: Fish, other edible aquatic plants and animals – Marine resources
- Medicines

Quinine for malaria from the bark of Cinchona tree,

Vinblastin and vincristine, two anticancer drugs, from Catharanthus roses plant

2. Productive use value: These are the commercially usable values where the product is marketed and sold.

Animal products: like tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, fir of many animals, lac from lac insects etc

- Pharmacist – New and better drugs/medicines
- Raw material for Industry – the paper and pulp industry, Plywood industry, Railway sleeper industry, Silk industry, textile industry, leather industry
- Agricultural – Developing new crops Better crops with plant breeding

Values of Biodiversity

3. Social Values:

Preserved as valuable resource many sacred and holy plants like- based on religion worship: Tulsi, Peepal, and animals like Cow.

4. Ethical and Moral values: Ethical responsibility to protect all life forms.

- Preservation of nature through local traditions.
- Conservation of biodiversity & economic importance.

5. Aesthetic Values: Preservation of its inherent value, beauty, aesthetics and creativity for tourist attraction.

- Indian mythology eulogies animals like elephant, snake and cow.
- No visit to barren land but to enriched biodiversity promote eco- turism Industry.

6. Option Value: Keeping future possibilities open for their use is called the option value. In nature many thing yet to explore, plant , microorganism.

- The preservation of biodiversity must also include traditionally used strains already in existence in crops and domestic animals.

Indian Biodiversity

- India has a rich biological diversity of flora and fauna.
- Overall 6% of the global species are found in India.
- India ranks 10th among the plant rich countries of the world,
- 11th in terms of number of endemic species of higher vertebrates
- 6th among the centers of diversity and origin of agricultural crops.
- The total number of living species identified in our country is 150,000.
- Out of a total of 25 biodiversity hot-spots in the world, India possesses 02
- i) Eastern Himalayas (North east Sikim Region)
- Ii) western ghats

INDIA AS A MEGA-DIVERSITY NATION

- India is one of the 12 mega-diversity countries in the world.
- The Ministry of Environment and Forests, Govt. of India (2000) records
- 47,000 species of plants (7% of world)and 4th in Asia
- 81,000 species of animals (6.5% of world).

350 mammal species – 8th in the world

1200 bird species – 8th in the world

453 reptile species -5th in the world

45,000 plant species – 15th in the world

Endemism: Species which are restricted only to a particular area are known as endemic.

INDIA AS A MEGA-DIVERSITY NATION

18% Indian plants are endemic to the country and found nowhere in the world

62% amphibians are endemic

50% of the lizards are endemic

Gene banks have collected - 34,000 cereals
- 22,000 pulses
- 27 breeds of cattle
- 40 breeds of sheep
- 22 breeds of goat
- 8 breeds of buffalos

Many of these are dying out due to misguided adoption of all foreign things.

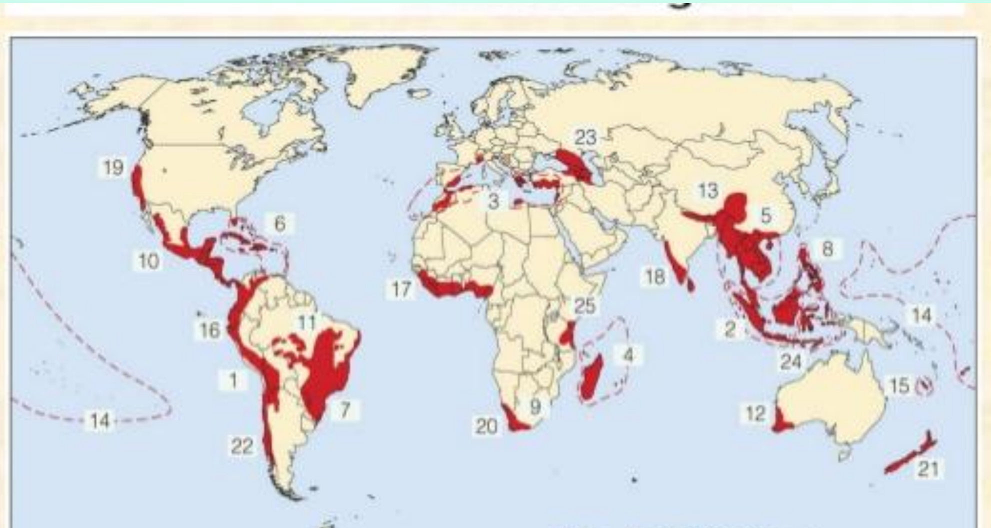
- MOEF is the nodal agency for implementation of CBD in India.
- National Biodiversity Action Plan (NBAP) was formulated in 2007

INDIA AS A MEGA-DIVERSITY NATION

- **Center of origin:**. Nearly 5000 species of flowering plants had their origin in India.
- center of origin of 166 species of crop plants and 320 species of wild relatives of cultivated crops,
- **Marine diversity:** Along 7500 km long coastline
- More than 340 species of corals. rich in mollusks, crustaceans (crabs etc.),
- Several species of Mangrove plants and sea grasses (Marine algae).
- 93 major wet lands, coral reefs and mangroves need to be studied
- Indian forests cover 64.01 million hectares having a rich biodiversity of plants in the Trans-Himalayan, north-west, west, central and eastern Himalayan forests, western ghats, coasts, deserts, Gangetic plains, deccan plateau and the Andaman, Nicobar and Lakshadweep islands.

HOT SPOTS OF BIODIVERSITY

- Areas which exhibit high species richness & high species endemism are termed as hot spots of biodiversity.
- 25 hot spots in world and 2 in India
- Eastern Himalayas, & Western Ghats
- · Hotspots covering less than 2% of the worlds land area contain 50% of the terrestrial biodiversity



Centre of Global biodiversity (Red)

- About 40% of terrestrial plants and 25% of vertebrate species are endemic and found in these hotspots.
- **Major hot spot in world** i) Tropical rain forests ii)Western Amazon, iii) Madagascar, iv)North and East Borneo, v) North Eastern Australia, vi) West Africa vii) Brazilian Atlantic forests.

HOT SOPT BIODIVERSITY IN INDIA

- 1. Indo-Burma region (covering Sikkim Eastern Himalayas)
- Sikkim rich in endemic plant species. Area of 7298 Km² of about 4250 plant species are found of which 60% are endemic.
- Sapria himalayana, aparasitic angiosperm was sighted only twice in this region in the last 70 years.

- Cradle of flowering plants.
- Out of the world's recorded flora 30% are endemic to India of which 35,000 are in the Himalayas.

HOT SOPT BIODIVERSITY IN INDIA

(2) Western Ghats: It extends along a 17,000 Km^2 strip of forests in Maharashtra, Karnataka, TN & Kerala

- 40% of the total endemic plant species.
- 62% amphibians and 50% lizards are endemic
- 500 m elevation covering 20% of evergreen forest while those in 500-1500 m range are semievergreen.
- Major centers of diversity are Agastyamalai Hills and
- Silent Valley. the New Amambalam Reserve Basin

Endemic plant and animals in western ghat:
Ternstroemia japonica, Rhododendron and Hypericum
Fairy blue bird, lizard hawk etc.

However, only 6.8% of the original forests are existing today while the rest has been deforested

Ternstroemia japonica

Fairy blue bird

Thank You

(Management Topic in Environmental Studies)

B. Tech 7^{TH} Semester

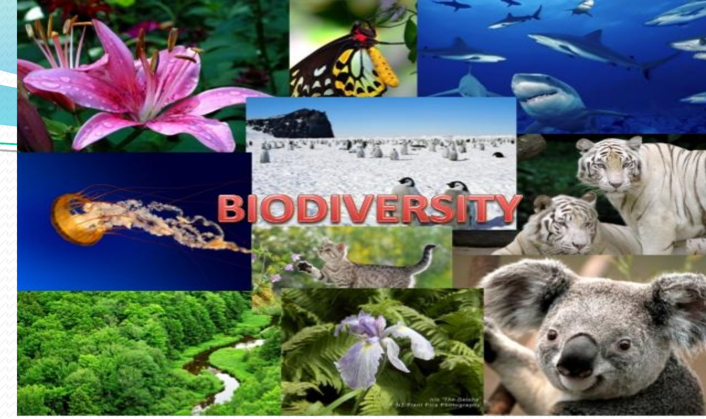
BIODIVERSITY (PART-2)

Department: Chemistry
Subject: MTES (CHM2049)

Contents

- Threats to Biodiversity
- Endangered and Endemic Species in India
- Red Data Book Classification of Wildlife
- Conservation of Biodiversity
- Organizations Working for Protection of Biodiversity

What is Biodiversity



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Biodiversity: It is concerned with the variety of individuals within populations, the diversity of species within communities, and the range of ecological roles within ecosystems

Recent Issues on Biodiversity

- Some 75 per cent of the genetic diversity of crop plants been lost in the past century.
- Some scientists estimate that as many as 3 species per hour are going extinct and 20,000 extinctions occur each year.
- Roughly one-third of the world's coral reef systems have been destroyed or highly degraded.
- About 24 per cent of mammals and 12 per cent of bird species are currently considered to be globally threatened.
- More than 50 per cent of the world's wetlands have been drained, and populations of inland water and wetland species have declined by 50per cent between 1970 and 1999.

One of the estimates by the noted ecologist, E.O. Wilson puts the figure of extinction at 10,000 species per year or 27 per day

THREATS TO BIODIVERSITY

There are different threats to biodiversity because of which their population is going on decreasing day by day. The threats may be natural on anthropogenic. Some of the causes are discussed below;

1. **HABITAT LOSS, DEGRADATION, FRAGMENTATION.**
2. **Causes of habitat loss:** Agriculture activities, Mining, large Hydro power plants, Urbanization and industry etc.

Habitat loss & degradation are major causes of species extinction, affecting

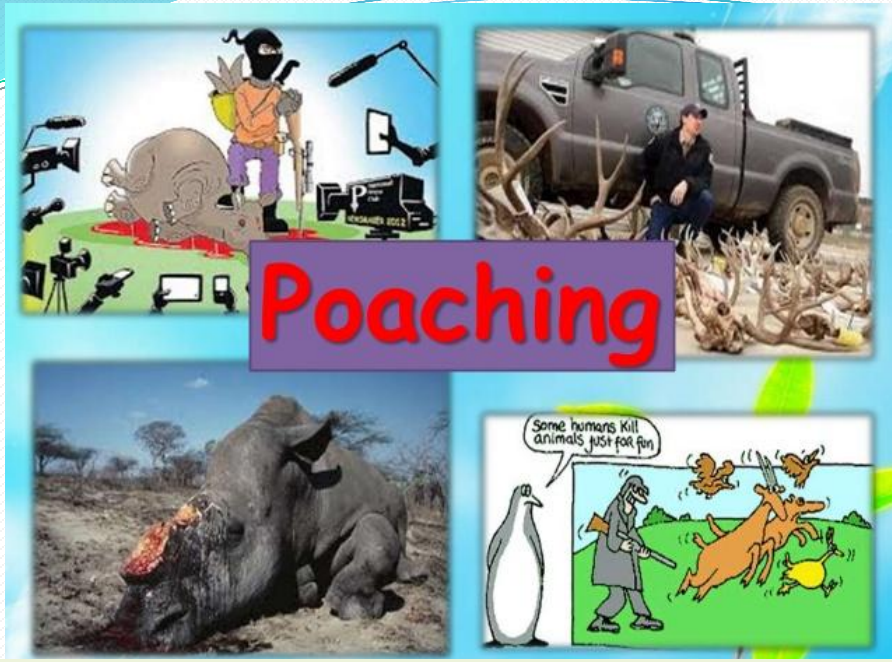
89% of all threatened birds,
83% of mammals &
91% of all threatened plants assessed globally (**IUCN, 2000**).

2. **POACHING OF WILDLIFE**
   - Poaching is another threat that has emerged in recent decades as one of the primary reason for decline in number of species.

Illegal wild life trade

- Wildlife is sold and traded in many countries for i) live specimens, ii) folk medicines, iii) furs, skin, and other products such as Ivory, horns etc amounting to millions of dollars.

THREATS TO BIODIVERSITY



Poaching is not limited to animals its also for plant

Menopause problem, Black Cohosh)

The cost of elephant tusks can go upto $ 100 per kg; the leopard fur coat is sold at $ 100,000 in Japan
$ 10,000 for a rare hyacinth macaw , a beautiful coloured bird, from Brazil.

Mental disease, Low BP, Diabetes (Ginseng)

THREATS TO BIODIVERSITY

3. MAN – WILDLIFE CONFLICTS

Due to the lack of stable food, shelter and disruption of movement, wild animals came out of forest area and attack the agricultural field and humans and in turn got killed by the humans.

4. INTRODUCTION OF EXOTIC SPECIES

Organisms introduced into new habitats where they are not native are termed as exotics are also considered as Biological Pollutants.

5. CLIMATE CHANGE AND ENVIRONMENTAL POLLUTION

- A changing global climate threatens species and ecosystems.
- The air, water and soil pollution are the major factor to extinct number of species in both terrestrial and aquatic ecosystems.
- Spread disease

Example :

The impact upon china's panda, ones found across the nation. Now it's only found in fragmented and isolated regions in the south west of the country as a result of wide spread deforestation in the 20th century.

There are natural causes too..

Habitat destruction through natural processes such as volcanism, fire and climate change is well documented in the fossil record. One

ENDANGERED SPECIES IN INDIA

According to The International Union of Conservation of Nature and Natural Resources (IUCN), the species that considered in imminent danger of extinction
and whose survival is unlikely, if factors causing their decline continue to operate.

Classification of plant and animal as per Red Data Book (IUCN 1964)

- Endangered (E)
- Vulnerable (V)
- Rare (R)
- Threatened (T)
- Out of danger (O)
- Indeterminate (I)

- **Endangered (E):** Species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.
- **Vulnerable (V):** Species believed likely to move into the endangered category in the near future if the casual factors continue operating.
- **Rare (R):** Species with, small world populations that are not at present endangered or vulnerable, but are at risk.
- **Threatened (T):** Threatened is used in the conservation context for species which are in one of the categories Endangered, Vulnerable and Rare.
- **Out of danger (O):** Species formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken
- **Inderterminate (I):** Species that are suspected of belonging to one of the first three categories, but for which insufficient information is currently available.

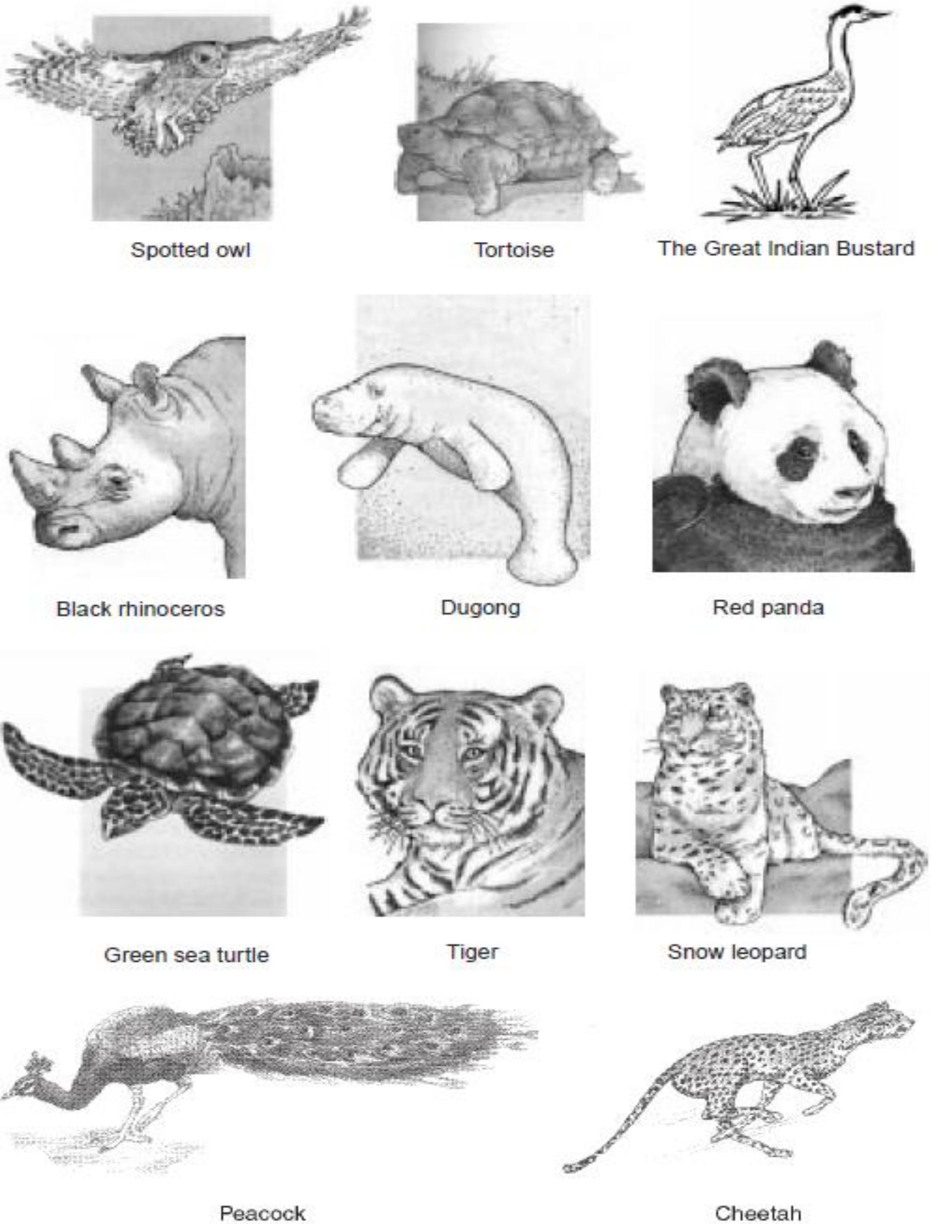
ENDANGERED SPECIES IN INDIA

450 plant species are endangered, threatened or rare in India
about 150 mammals and 150 species of birds are threatened
unknown number of species of insects are endangered

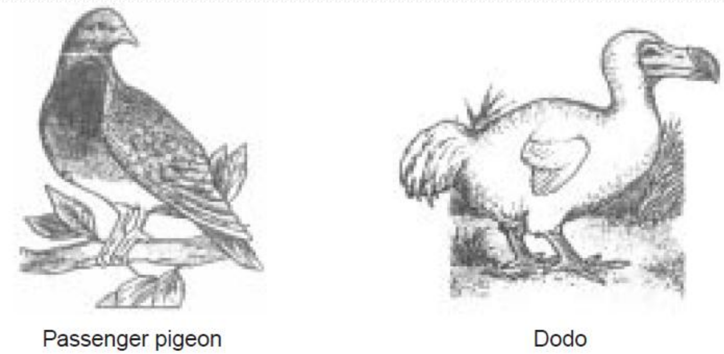
(*a*)	Reptiles	:	Gharial, green sea turtle, tortoise, python
(*b*)	Birds	:	Great Indian bustard, Peacock, Pelican, Great Indian Hornbill, Siberian White Crane
(*c*)	Carnivorous Mammals	:	Indian wolf, red fox, Sloth bear, red panda, tiger, leopard, striped hyena, Indian lion, golden cat, desert cat, dugong
(*d*)	Primates	:	Hoolock gibbon, lion-tailed macaque, Nilgiri langur, Capped monkey, golden monkey
(*e*)	Plants	:	A large number of species of orchids, Rhododendrons, medicinal plants like *Rauvolfia serpentina*, the sandal wood tree *Santalum*, *Cycas beddonei* etc.

The Zoological Survey of India reported that Dudo, Passenger pigeon, Pink headed duck and mountain quail have already become extinct from India.

Some important endangered & extinct species



Endangered



Extinct

➢In India, 53 species of mammals, 69 birds, 23 reptiles and 3 amphibians are considered as threatened species.

➢As many as 3,000- 4,000 higher plants may be under high degree of threat in India.

ENDEMIC SPECIES OF INDIA

Out of about 47,000 species of plants in India 7000 are endemic.
62% endemic flora, restricted mainly to Himalayas, Khasi Hills and Western Ghats. Example:,

Nepenthes khasiana

Trooth brush Orchid

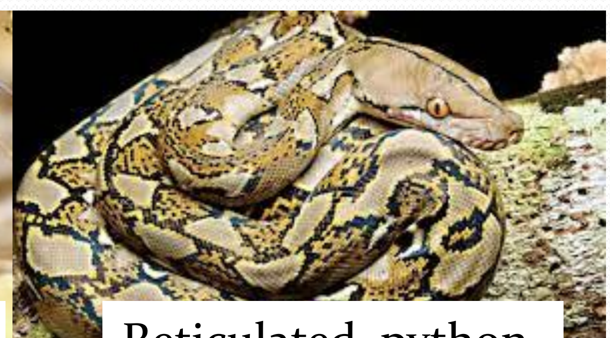
Platycerium alcicorne

Sapria himalayana

About 62% amphibians and 50% lizards are endemic to Western Ghats.
Different species in India as below

Viviparous toad

monitor lizards



Reticulated python

Indian Salamander

Biodiversity Convensions

- The first convention on biodiversity organized at Rio De Janerio, capital of Brazil from June 5 to 16, 1992 named as United Nation Conference On Environment and Development (UNCED), batter known as Rio Summit to maintain ecological balance and enrich biodiversity. The agreement on biodiversity signed by 150 countries including three programmes-

❖ To ensure conservation of biodiversity

❖ Sustainable use of biodiversity

❖ Rational and equitable share of profit to accrue from use of genetic resources.

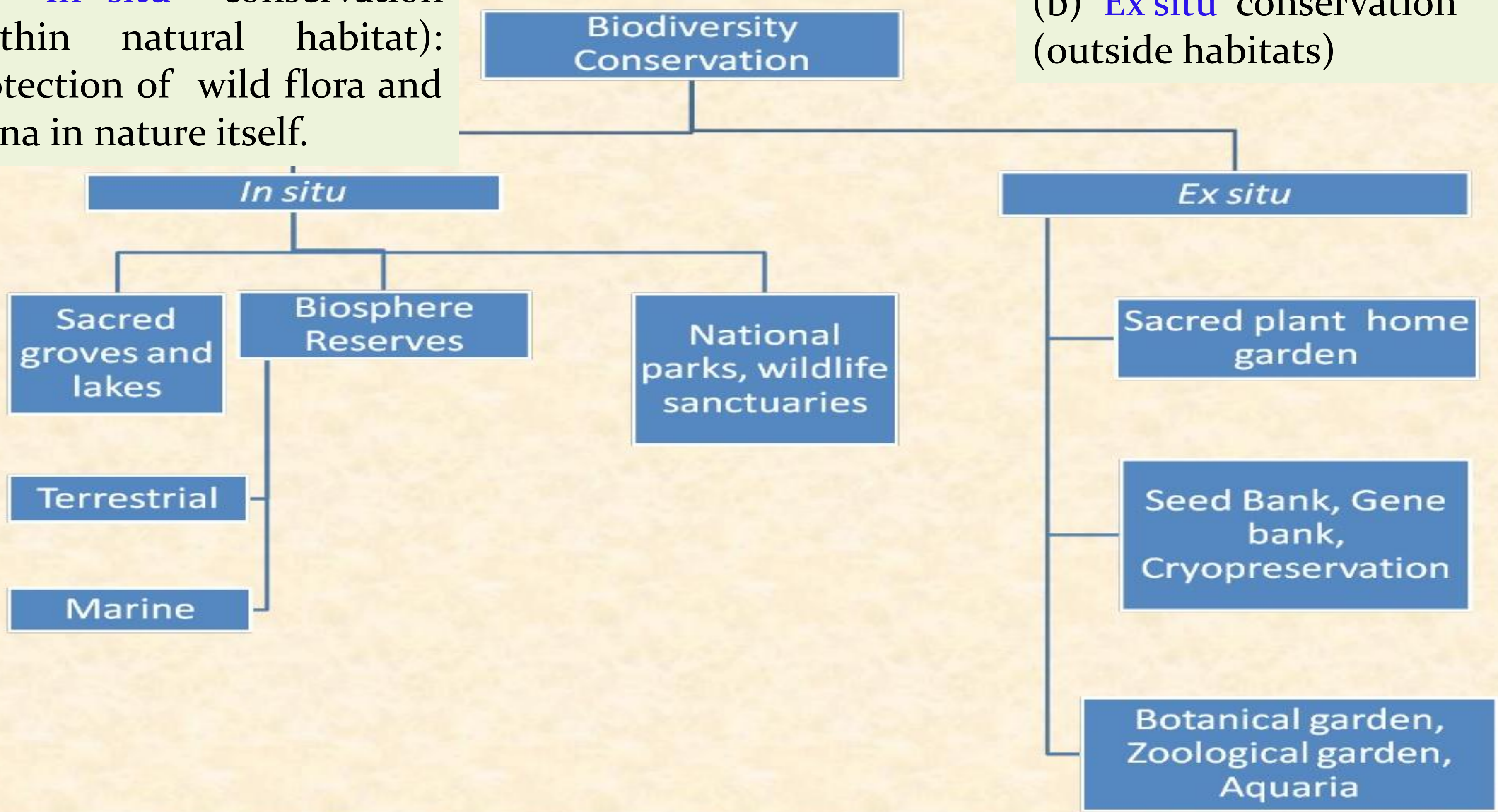
- The second convention organized at Johannesburg in 2002 called World Summit On Sustainable Development (WSSD) where the Biodiversity and Sustainable Ecosystem Management was the issue.

CONSERVATION OF BIODIVERSITY

Conservation is defined as "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of the future generations".

(a) In situ conservation (within natural habitat): protection of wild flora and fauna in nature itself.

(b) Ex situ conservation (outside habitats)



In- Situ conservation

It simply means conservation of species in its natural ecosystem or habitat through a network of “protected area”.diversity and managed through legal effective means.

At present we have 7 major Biosphere reserves, 80 National Parks, 420 wild-life sanctuaries and 120 Botanical gardens in our country covering 4% of the geographic area.

These include:-

- Biosphere reserves
- National parks

- Wild Life Sanctuaries etc.

Bandhavgarh National Park

Biosphere

Biosphere Reserves have been described as undisturbed natural areas for scientific study as well as areas in which conditions of disturbance are under control. These serve as the centre for ecological research and habitat protection, The "Biosphere Reserve consists of two main zones as:
as a whole for long-term in situ conservation.

1. Core zone (undisturbed area)
2. Buffer zone(open for tourism)

. Objectives :

- Conserve biological diversity
- Safeguard genetic diversity
- Provide areas for basic and applied research
- Opportunity for Environmental Science and training
- Promote international cooperation
- Promote management of biotic resources.

Preserve and protection of local tribal people

Indian Government has established 18 Biosphere Reserves
Nanda Devi (U.P.), Nokrek (Meghalaya), Manas (Assam), Sunderbans (West Bengal), Gulf of Mannar (Tamil Nadu), Nilgiri (Karnataka, Kerala, Tamil Nadu), Great Nicobars and Similipal (Orrisa) biosphere Reserves.

National park in India

Bandhavgarh National Park

A National Park is an area dedicated for the conservation of wildlife along with its environment facilitate truism

Grazing of domestic animals, all private rights and forestry activities are prohibited . conservation specifically of some particular species of wildlife along with others.

Name of National Park	State	Important Wildlife
Kaziranga	Assam	One horned Rhino
Gir National Park	Gujarat	Indian Lion
Dachigam	J & K	Hangul
Bandipur	Karnataka	Elephant
Periyar	Kerala	Elephant, Tiger
Kanha	M.P.	Tiger
Corbett	U.P.	Tiger
Dudwa	U.P.	Tiger
Ranthambore	Rajasthan	Tiger
Sariska	Rajasthan	Tiger

India's first national park was established in 1936 as Hailey National Park, now known as Jim Corbett National Park.

Wildlife sanctuary

The Indian Board for Wild Life has defined a sanctuary as, 'An area where killing, hunting, shooting or capturing of any species of bird or animal is prohibited except by or under the control of highest authority in the department responsible for the management of the sanctuary and whose boundaries and character should be very important as far as possible.

Some major wildlife sanctuaries of our country

Name of Sanctuary	State	Major Wild Life
Ghana Bird Sanctuary	Rajasthan	300 species of birds (including migratory)
Hazaribagh Sanctuary	Bihar	Tiger, Leopard
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Nal Sarovar Bird Sanctuary	Gujarat	Water birds
Abohar Wildlife Sanctuary	Punjab	Black buck
Mudamalai Wildlife Sanctuary	Tamil Nadu	Tiger, elephant, Leopard
Vedanthangal Bird Sanctuary	Tamil Nadu	Water birds
Jaldapara Wild Life Sanctuary	W. Bengal	Rhinoceros, elephant, Tiger
Wild Ass Sanctuary	Gujarat	Wild ass, wolf, nilgai, chinkara

Private ownership rights are permissible and forestry operations are also permitted to an extent that they do not affect the wildlife adversely

Sanctuary

- **For plants,** there is one gene sanctuary for Citrus (Lemon family) and one for pitcher plant (an insect eating plant) in Northeast India.
- Project for the protection and conservation of certain animals, e.g.
- Project Tiger, Gir Lion Project,
- Crocodile Breeding Project,
- Project Elephant,
- Snow Leopard Project

ZOO

Ex- Situ conservation

Gene Bank

It is defined as "the conservation of component of biological diversity (Sample of genetic diversity, particularly of endangered species) outside their natural habitats".

1. Botanical/ zoological gardens, aquarium and research centre.

(i) There are more than 1500 Botanical gardens in the world containing more than 80,000 species. There are more than 800 zoos around the world with about 3,000 species of mammals, birds, reptiles and amphibians.

(ii) **National Bureau of Plant Genetic Resources (NBPGR)** New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryo-preservation of seeds, pollen etc. by using liquid nitrogen at a temperature as low as -196°C.

(iii) **National Bureau of Animal Genetic Resources (NBAGR)** Karnal, Haryana. It preserves the semen of domesticated bovine animals.

(iv) **National Facility for Plant Tissue Culture Repository (NFPTCR)** for the development of a facility of conservation of varieties of crop plants/trees by tissue culture.

Thank You

(Management Topic in Environmental Studies)

B. Tech 7TH Semester

WATER POLLUTION (Part 1)

Department: Chemistry
Subject: MTES(CHM2049)

Contents

- Introduction to water pollution
- Types of water pollutants
- Sources of water pollution
- Effect of water pollution
- Eutrophication
- Bio-magnification
- **Some common measures to control pollution**

WATER POLLUTION

- Water pollution means undesirable changes in physical, chemical or biological properties of water that makes it unfit for use by human and other living beings.
- There are certain symptoms of water pollution: changed colour, offensive smell, bad taste, unchecked growth of aquatic weeds, oily material floating on surface, and death of fish and other aquatic organisms.



Facts????

- Only about 3% surface water is fresh water
- One fifth of the world's population lacks the access of clean water
- Over 2.6 billion people do not have adequate toilets.
- More than 2 million children are killed by diarrheal diseases each year
- Demand of water will double in next 30 years

Causes of Water Pollution?

- Water is uniquely vulnerable to pollution. Known as a "universal solvent,"
- Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

Water pollutants: Types

Organic pollutants: Mainly derivatives of living beings, while some are synthetic. They include

(a) Natural organic pollutants: faecal content, dead and decaying plant and animal,

(b) Sewage and industrial effluents,

(c) Synthetic organic chemicals (SOCs): Pesticide, herbicide, dioxin Polychlorinated biphenyl,

(d) Microbiological pollutants: bacteria, virus, fungi, etc

(e) Oils: marine pollution by spillage and leakage from ship carrying refinery oil .

Inorganic pollutants: *example* mineral acids, bases, salts, metals, heavy metals etc. They come from natural sources (rocks) as well as man made sources (industries).

Example SO_4, NO_3, PO_4, Cyanide, Fluoride, chloride etc, Heavy metal: Pb, Cr, Cd, Hg, As etc

Radioactive pollutants: ***R***eleased into water from natural sources (rocks) as well as man made sources (nuclear waste, weapons etc.) uranium , thorium etc

Suspended solids and sediments: These include insoluble impurities like soil, sand and other solid particles which either remain as suspension in water or form sediments.

Sources of water pollution:

Heat or thermal pollution: Heated water from thermal power plants and industries. This increases temperature of water and decreases dissolved oxygen.

Sources of water pollution

Major sources of water pollution include:

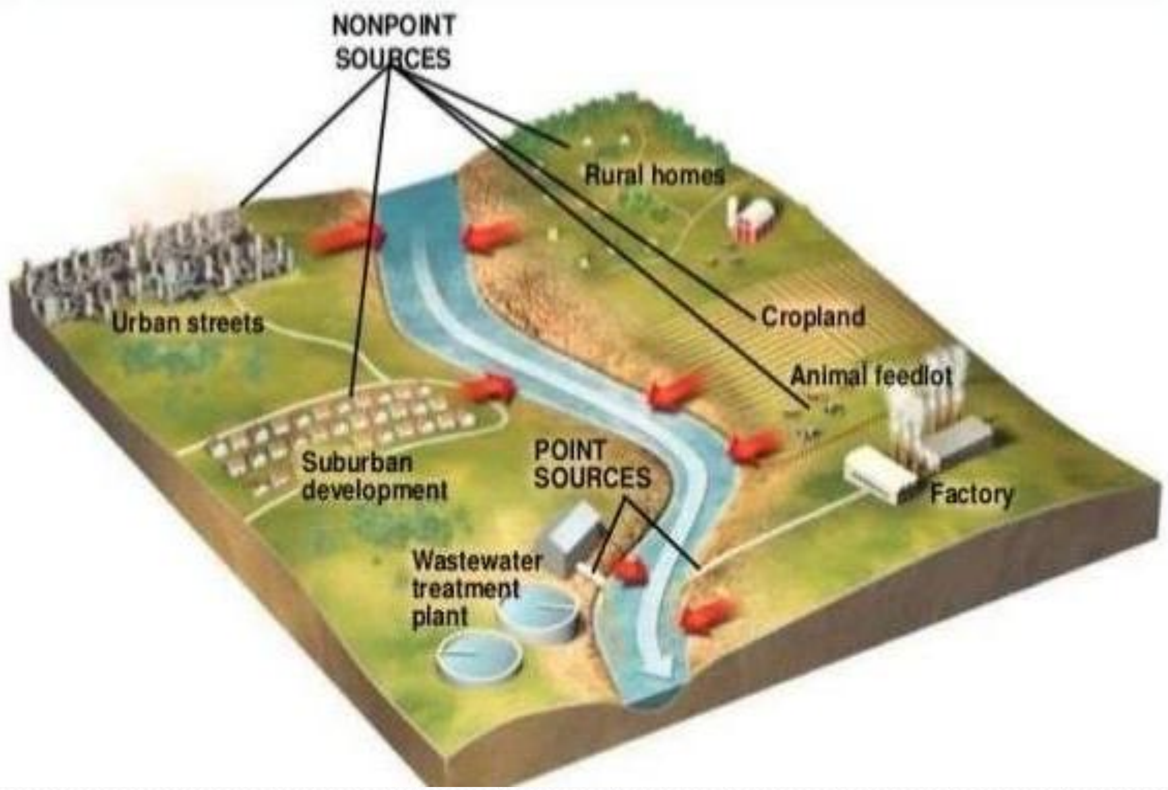
- **Nature** (death and decay of plants and animals): Faecal content increase BOD and COD level
- **Soil erosion** due to deforestation, overgrazing etc
- **Agricultural run-off:** Pesticide herbicide, fertilizer
- **Mining** (acid mine drainage),
- **Municipal sewage**,
- **Industrial effluents**: Petrol chemical, paper pulp, pharmaceutical, coke oven plant
- **Accidental spillage etc.:** during transport, storage and handling, Accident during ship carrying refinery oil

Sources of water pollution

There are two types of sources of water pollution:

- ***Point sources:*** Sources whose location can be identified as single point. e.g., sewage and industrial effluent

- ***Non-point or diffused or area sources:*** Sources that are scattered over a large area or that can not be identified as single point. e.g., run-off from agricultural land, forests etc



Effects of water pollution

Physical effects: It includes increased temperature, turbidity, conductivity, depletion of dissolved oxygen (DO), altered colour, oily surface etc. This results in reduced photosynthesis and loss of aquatic life.

Oxidation effects: It includes biological and chemical oxidation. As a result of this different impurities get oxidized (e.g., sulphides into sulphate, ammonia into nitrite and nitrates) at the cost of dissolved oxygen.

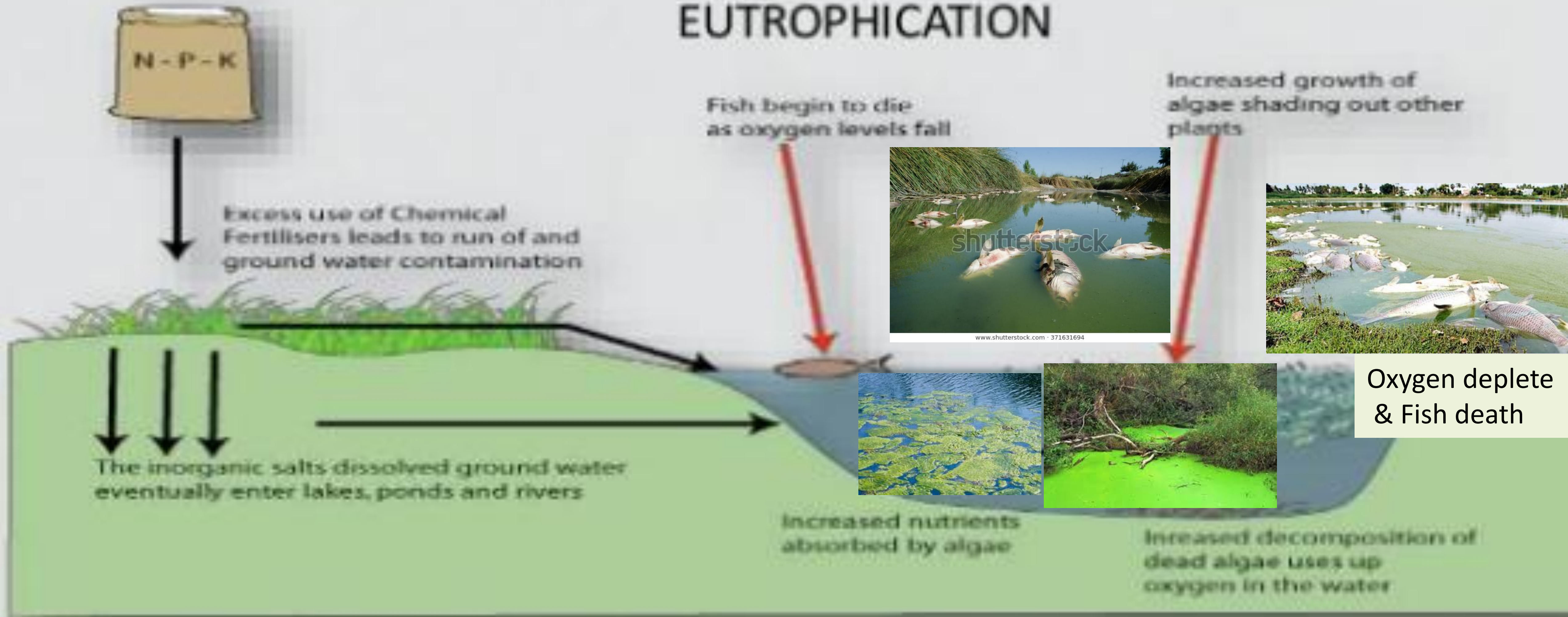
Toxic chemical effects: *Causes* fatal diseases or deaths of living beings. e.g., toxic metals like cadmium, mercury, chromium cause damage to liver, kidney and brain.

Similarly pesticides, acids, dioxins cause damage and cause cancer.

Micro-organism effects: Different micro-organisms (e.g., bacteria, virus) found in dirty water cause a number of water borne diseases e.g., cholera, typhoid, hepatitis, dysentery etc.

Eutrophication

Fertilizers such as nitrates and phosphates are used to improve crop yield reach through irrigation, rainfall and drainage into rivers and ponds. They cause serious illness metheamoglobin.



Industrial Effluents

- The industrial wastes and their effluents include poisonous materials like acids, alkalis, salts, phenols, cyanides, zinc, insecticides which makes water toxic and deoxygenated and eventually do not support aquatic life.

- MERCURY- Minamata disease.

Neurological syndrome caused by severe mercury poisoning. Symptoms include ataxia, (loss of full control on body movement) numbness (Burning feeling) in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech

- OILS- Oil reduce rate of oxygen uptake by water, retards light intensity by 90%.

ITAI-ITAI Disease: (Cd) Osteomylecia, sever bone pain renal dysfunction

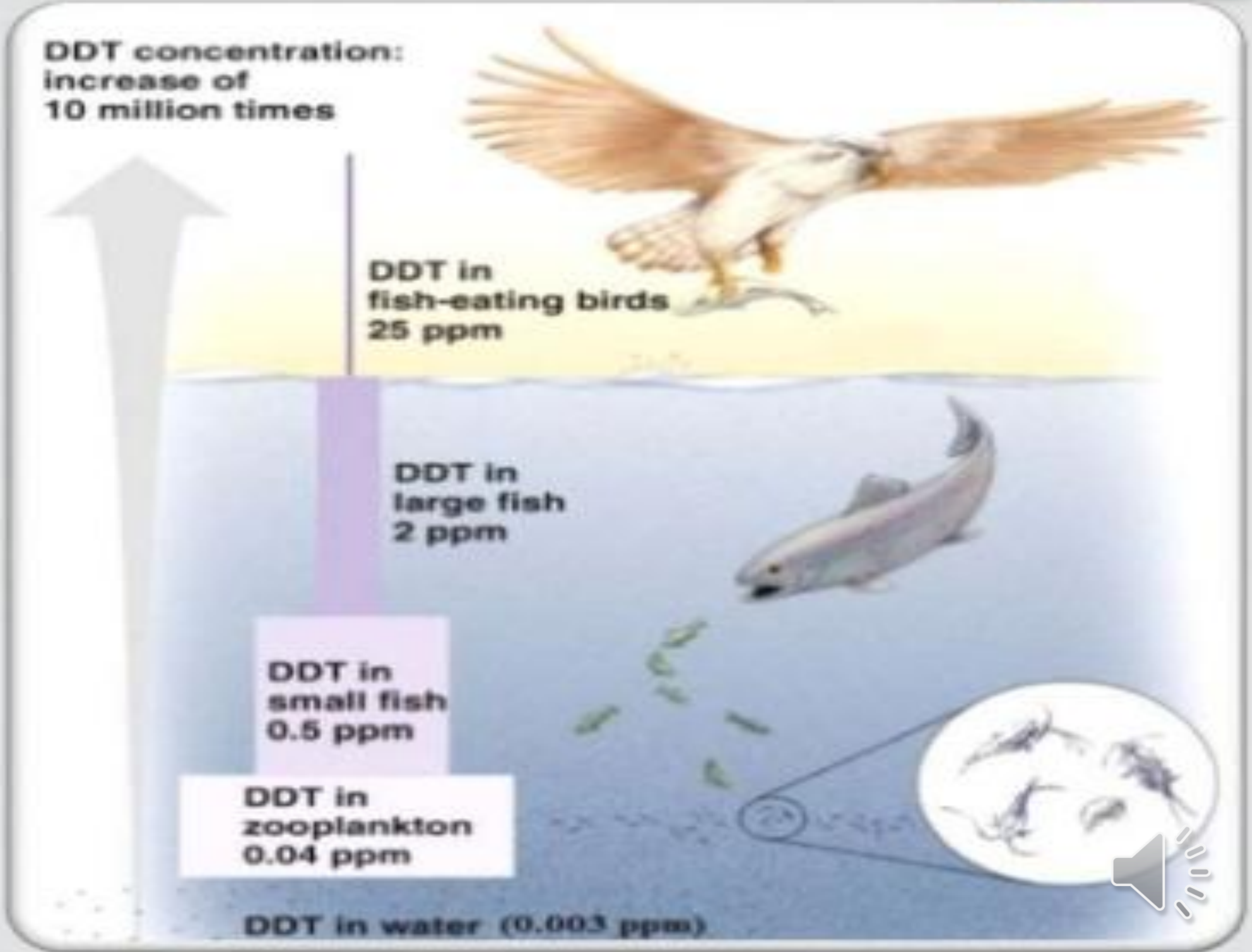
- BLACK FOOT DISEASE (Arsenic), ASBESTOSIS (Asbestos), BERYLLIOSIS (Beryllium), ITAI- ITAIdisease (Cadmium).

Insecticide and Pesticides Biomagnification

- They are biologically active chemicals are used for pest control. These include DDT (dichlorodiphenyltrichloroeth-ane), aldrin etc.

Even Hg, Pb, Cd, As etc

- Increased accumulation of these toxic substance in the food chain at high trophic level is called **BIOLOGICAL MAGNIFICATION**.



Some common measures to control pollution

- Domestic and industrial waste waters should be discharged into rivers only after proper treatment through STPs and ETPs.
- Solid wastes must not be mixed with liquid wastes and should not be thrown into to water bodies. They should be separately managed.
- Sources of drinking water should be protected from pollution. Polluting activities (e.g., industrial use, discharging effluents, bathing, washing, cattle rearing etc.) must be avoided in vicinity of source of drinking water.
- Water bodies should be regularly cleaned of aquatic weeds, plants and other crude impurities like polythene, metals, garbage etc. Special breeds of fish, Gambusia fish which feed on mosquito eggs and bacteria, can be cultured in water bodies.
- Afforestation must be done for reducing soil erosion and improving local soil hydrology. Use of agrochemicals need to be minimized.
- Public awareness regarding water pollution and its control measures should be created.

Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU

alamy stock photo

(Management Topic in Environmental Studies)

B. Tech 7TH Semester

WATER POLLUTION Part-2 (Treatment)

Department: Chemistry
Subject: MTES(CHM 2049)

Contents

- Introduction to water pollution control strategy
- Need of wastewater treatment
- Methods of water treatment
- Preliminary water treatment (Screening, grit removal, oil and grease removal, coagulation and flocculation)
- Secondary/ biological water treatment (Activated sludge process, Trickling filter, UASB reactor)
- Tertiary treatment
- **Common measures to control pollution**

Why do we need to treat wastewater ?

- To prevent groundwater pollution
- To prevent sea shore
- To prevent soil
- To prevent marine life
- Protection of public health
- To reuse the treated effluent

  For agriculture

  For groundwater recharge

  For industrial recycle

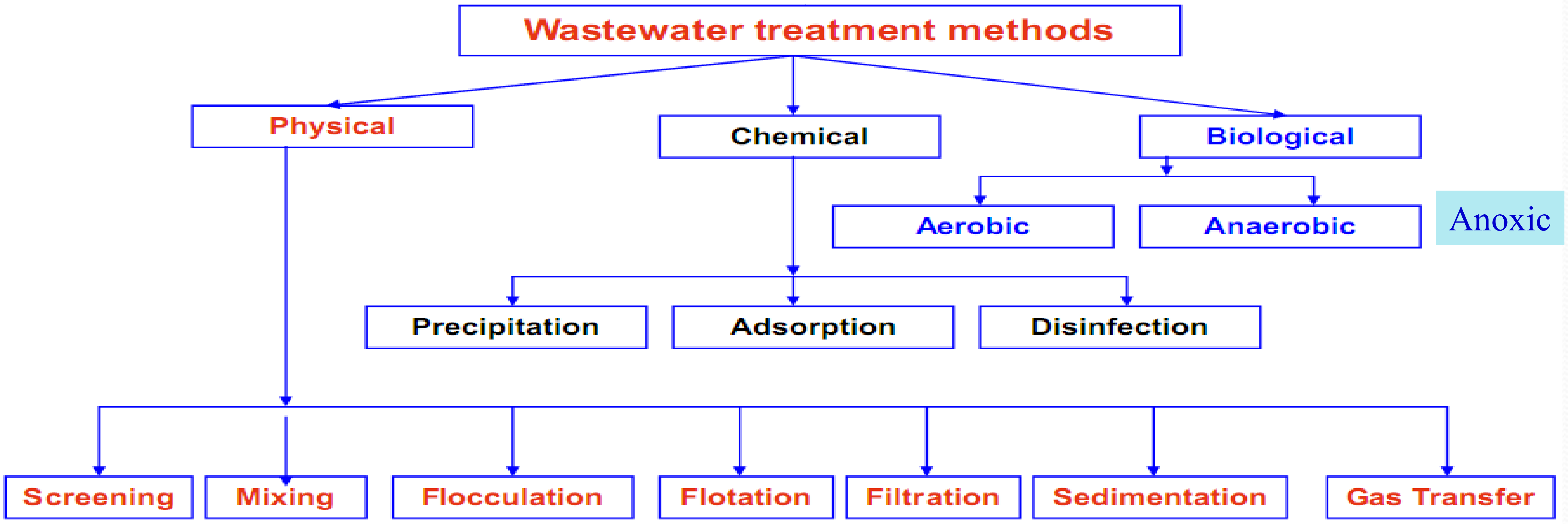
- Solving social problems caused by the accumulation of wastewater

Control measures and prevention of water pollution

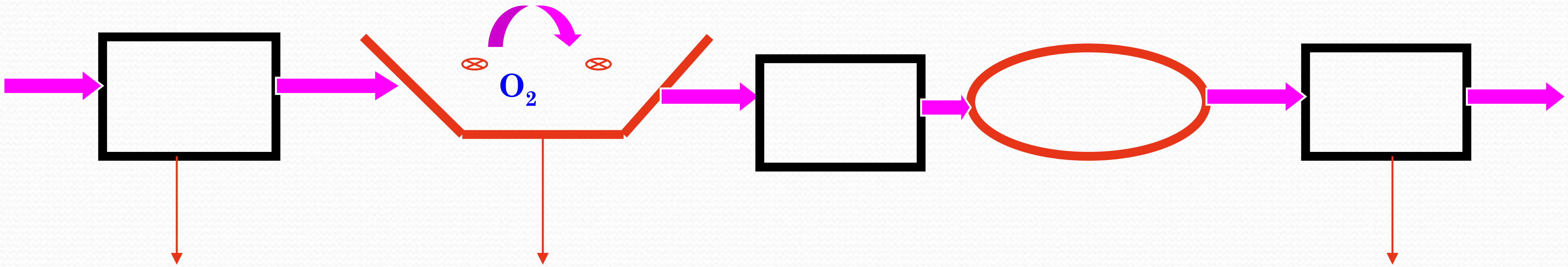
Following strategies are adopted for controlling water pollution:

- Two approaches are used: input control and output control.
- Input control means 'reducing generation of pollutants' while output control means 'controlling pollutants after being produced'.
- Output control further involves two strategies: volume reduction and strength reduction. Volume reduction: means reducing total volume of pollutant
- Strength reduction: means reducing harmful effects of pollutants.
- Both, volume and strength of the polluted water can be reduced by different types of water treatment plants (WTP). This includes
- Sewage Treatment Plants (STP) and
- Effluent Treatment Plants (ETP).

Wastewater treatment Methods



Wastewater Treatment Process



Primary treatment

- Screening
- Grit removal
- Removal of oil
- Sedimentation

Secondary treatment

- Aerobic, anaerobic lagoons
- Trickling filter- activated sludge- oxidation ditch
- Mostly BOD soluble organic pollutant removal technology

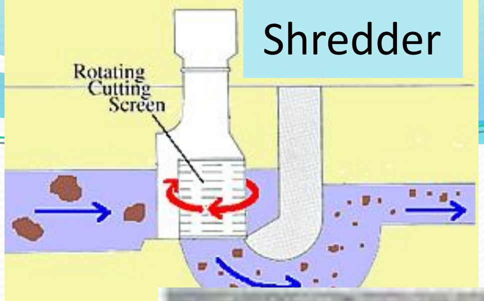
Tertiary treatment

- Nitrate removal
- Phosphorus removal
- Disinfection

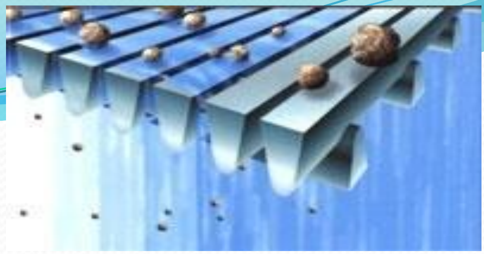
Preliminary Treatment

This involves the removal of floating material, settle able inorganic solids, and greasy materials.

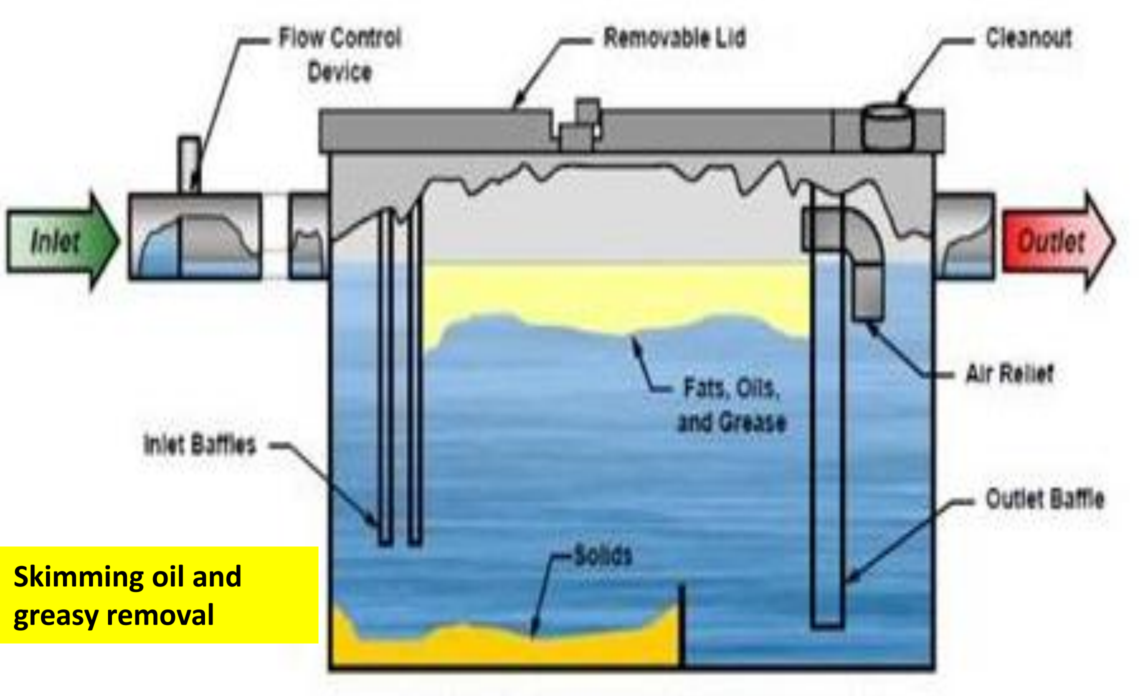
- **SCREENERS** - Device with opening and further classified as coarse (75-150mm), medium (20-70mm) and fine (<20mm).
- **SHREDDER** - Special device that cut and retain floating and suspended material.
- **GRIT CHAMBERS** -Heavy inorganic material can be removed. Based on principle of sedimentation.
- **SKIMMING TANK** -Greasy material can be removed using skimming tank which is divided into 3 compartments.



Shredder



Screening bar/plate



Hydromechanical Grease Interceptor

Skimming oil and greasy removal

Sedimentation tank or Grit Channel

- It is aimed at removal of suspended organic solids that cannot be removed in preliminary treatment. It involves the process of sedimentation.
- Sedimentation is the separation from water by gravitational settling if suspended particles are heavier than water

Sedimentation tank have inlet zone, settling zone, outlet zone, sludge zone.

Principle: Suddenly increase in flow cross sectional area of the influent wastewater from a to A at constant flow rate, the horizontal velocity of the wastewater carrying sand and silt drop down from V to v when it enter in to the settling chamber with high cross sectional area from a pipe (small cross sectional area) thus the horizontal momentum of the sand and silt suspended in in the water decreases and the gravitational force over come the horizontal momentum, as a result the particulate matter move down ward due to gravity and settled in the bottom, and clean water in the out pipe of the grit channel

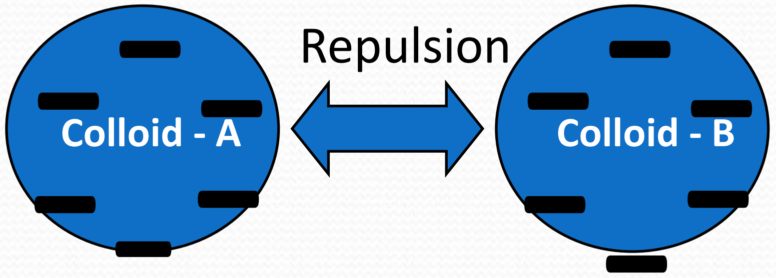
Coagulation and Flocculation

✓Colloids have a net negative surface charge (size 10^{-6} to 10^{-9} m)

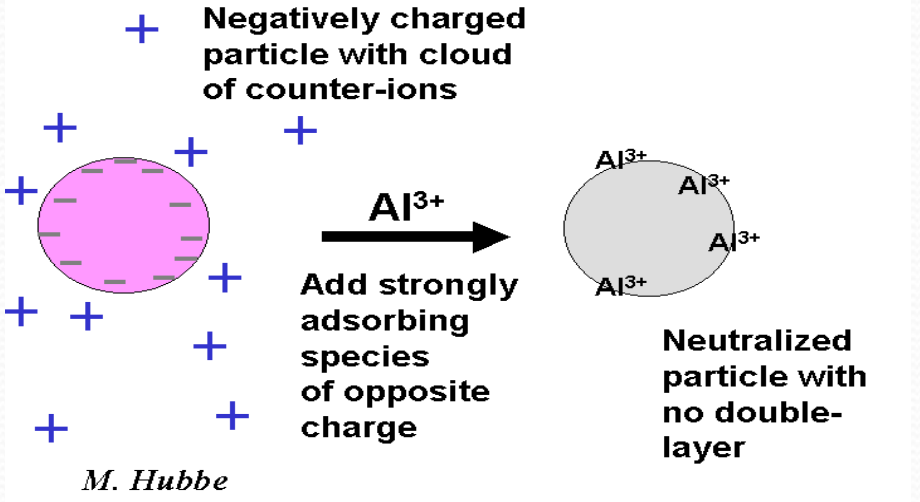
✓ Electrostatic repulsive force prevents them from agglomeration

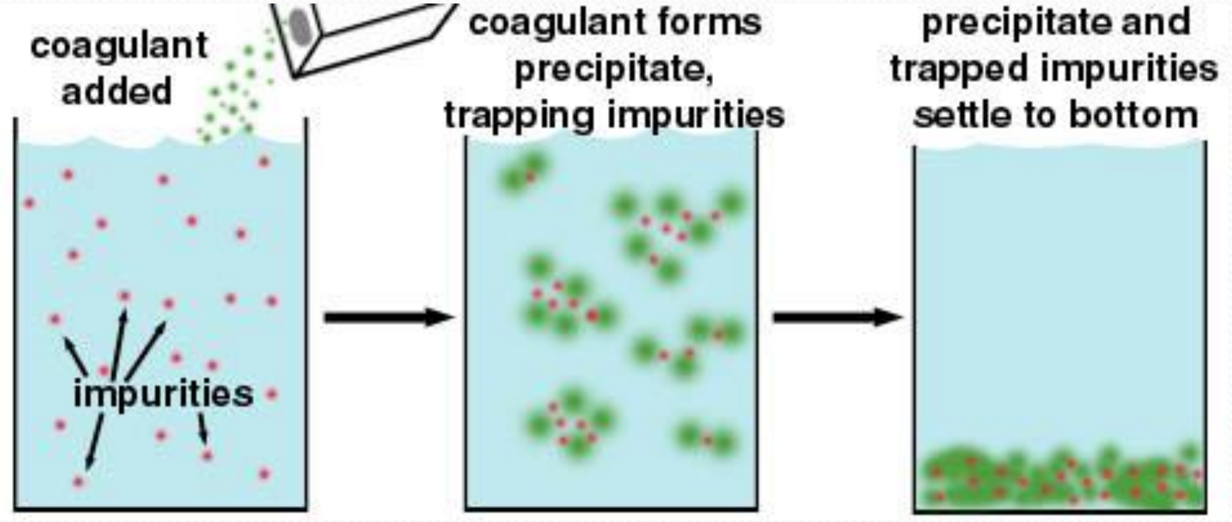
❑ **Coagulation** is the destabilization of colloids by addition of chemicals that neutralize the negative charges

❑ The chemicals are known as coagulants, usually higher valence cationic salts (Al^{3+}, Fe^{3+} etc, $AlSO_4$, $FeCl_3$



- Coagulants can be used to reduce the electrostatic repulsive forces
- The electrostatic repulsion reduced by the addition of countercharged ions [Al^{3+}]

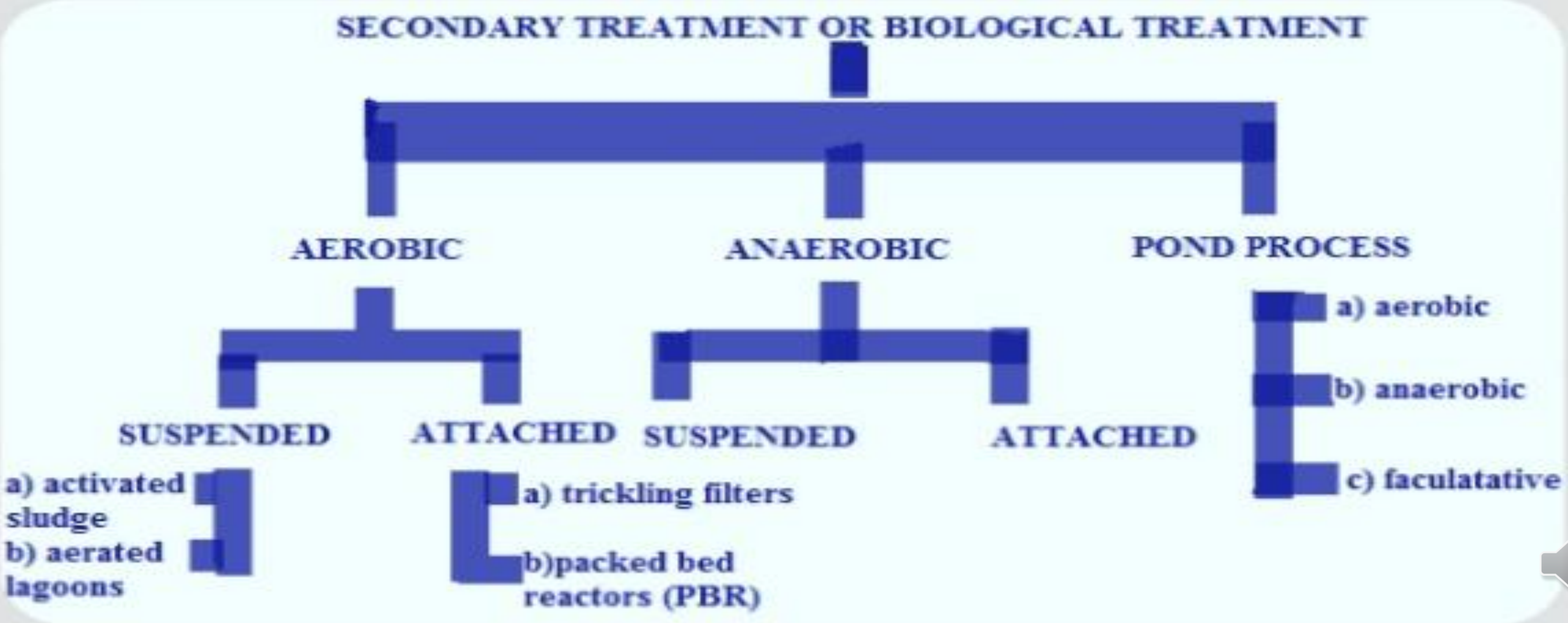




Flocculation is the agglomeration of destabilized/neutralized particles into a large size particles known as flocs which can be effectively removed by sedimentation due to gravity.

Secondary/Biological Treatment

- It is required to remove dissolved and fine colloidal organic matter. This process involves the use of microorganisms that decompose the unstable organic matter to stable inorganic forms.



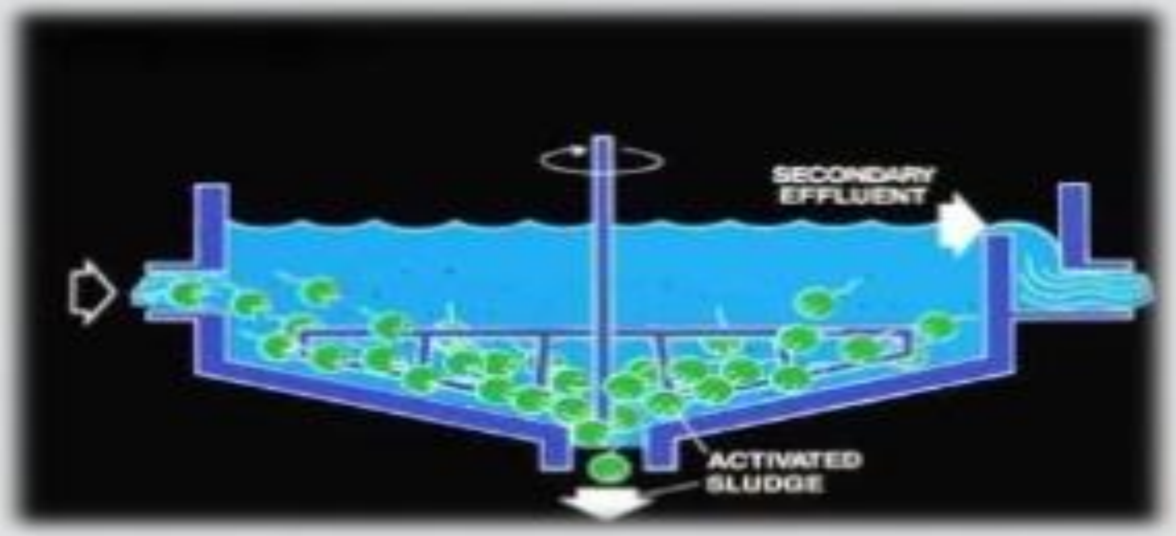
Aerobic Suspended Growth Treatment process

1) **ACTIVATED SLUDGE PROCESS**:- The sewage containing organic matter with microorganism is aerated in an aeration tank.

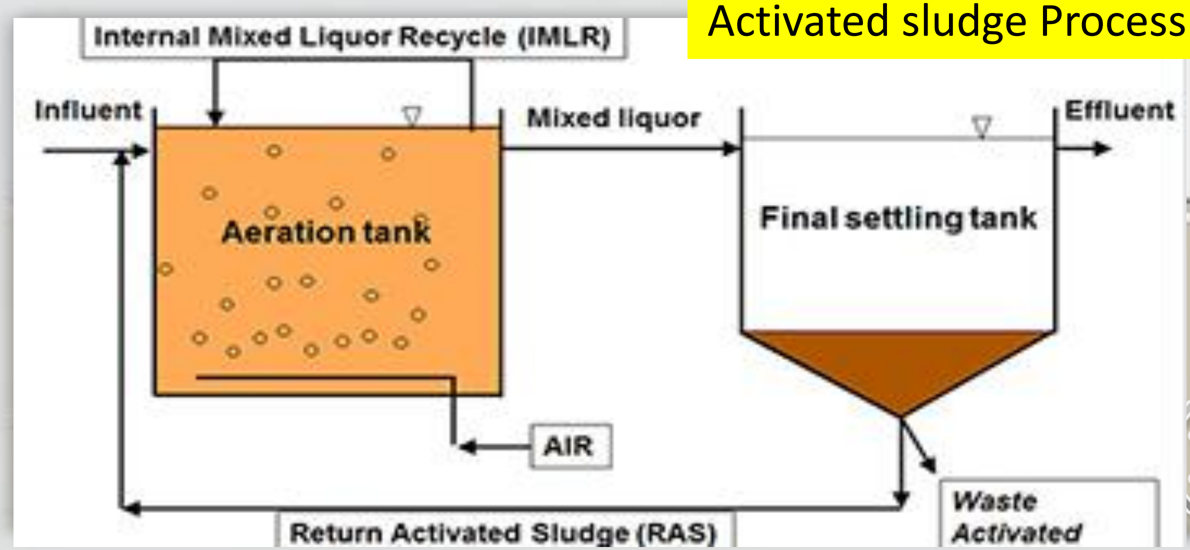
Advantage- cost effective, sludge has higher fertilizer value.

$$\textit{Organic materials} + \textit{Nutrients/Mineral} + O_2 \xrightarrow[\text{Aerobic microbes With favorable Temp , pH \& DO}]{} + CO_2 + NH_3 + H_2O + \textit{Biomass} + \textit{End product}$$

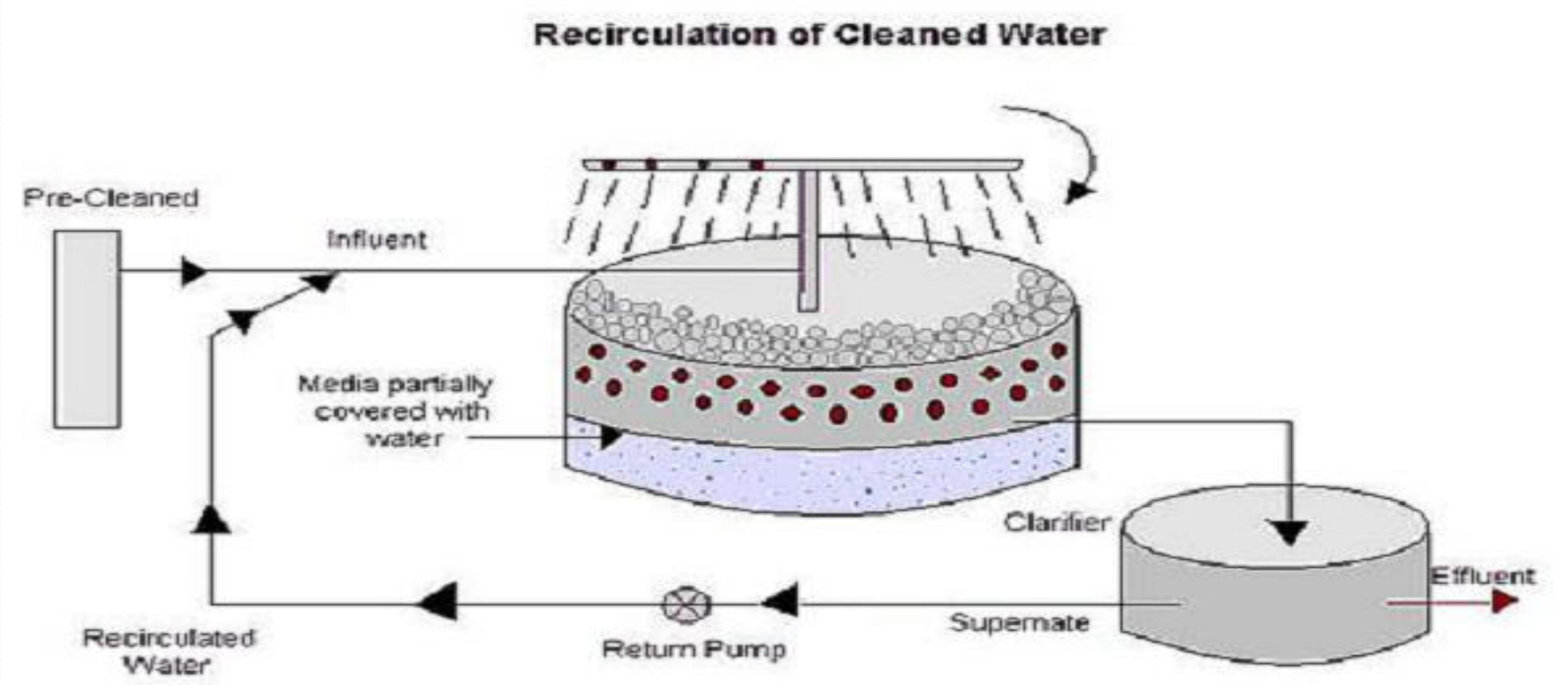
2) **AERATED LAGOONS** :- They are also known as aerated ponds, are the facultative stabilization ponds wherein surface aerators are installed to overcome bad odors.



Activated sludge Process



Trickling Filter



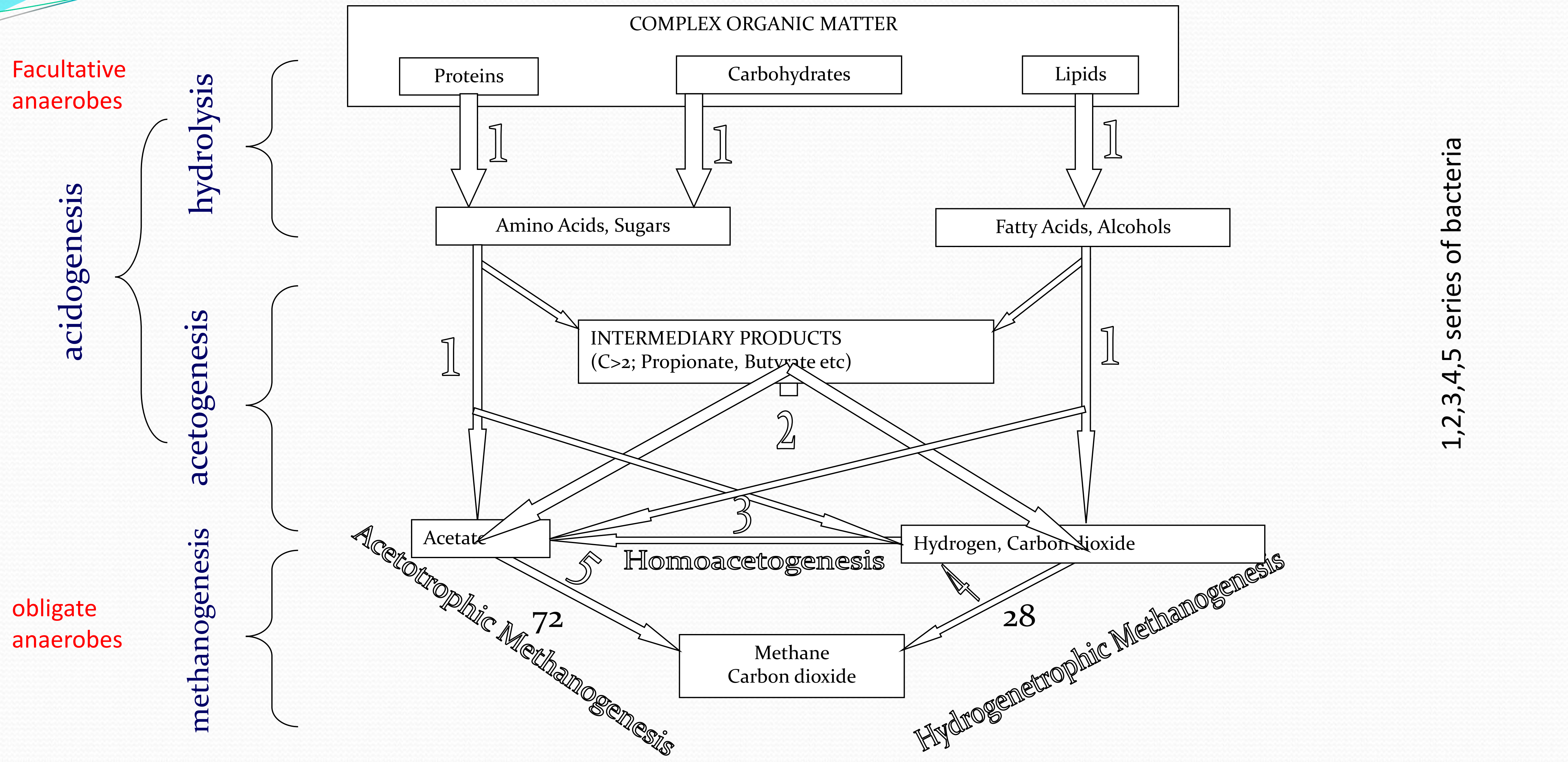
Anaerobic Wastewater Treatment

Anaerobic treatment is a biological process carried out in the absence of O_2 for the stabilization of organic materials by conversion to CH_4 and inorganic end-products such as CO_2 and NH_3

Anaerobic microbes
With favorable Temp , pH

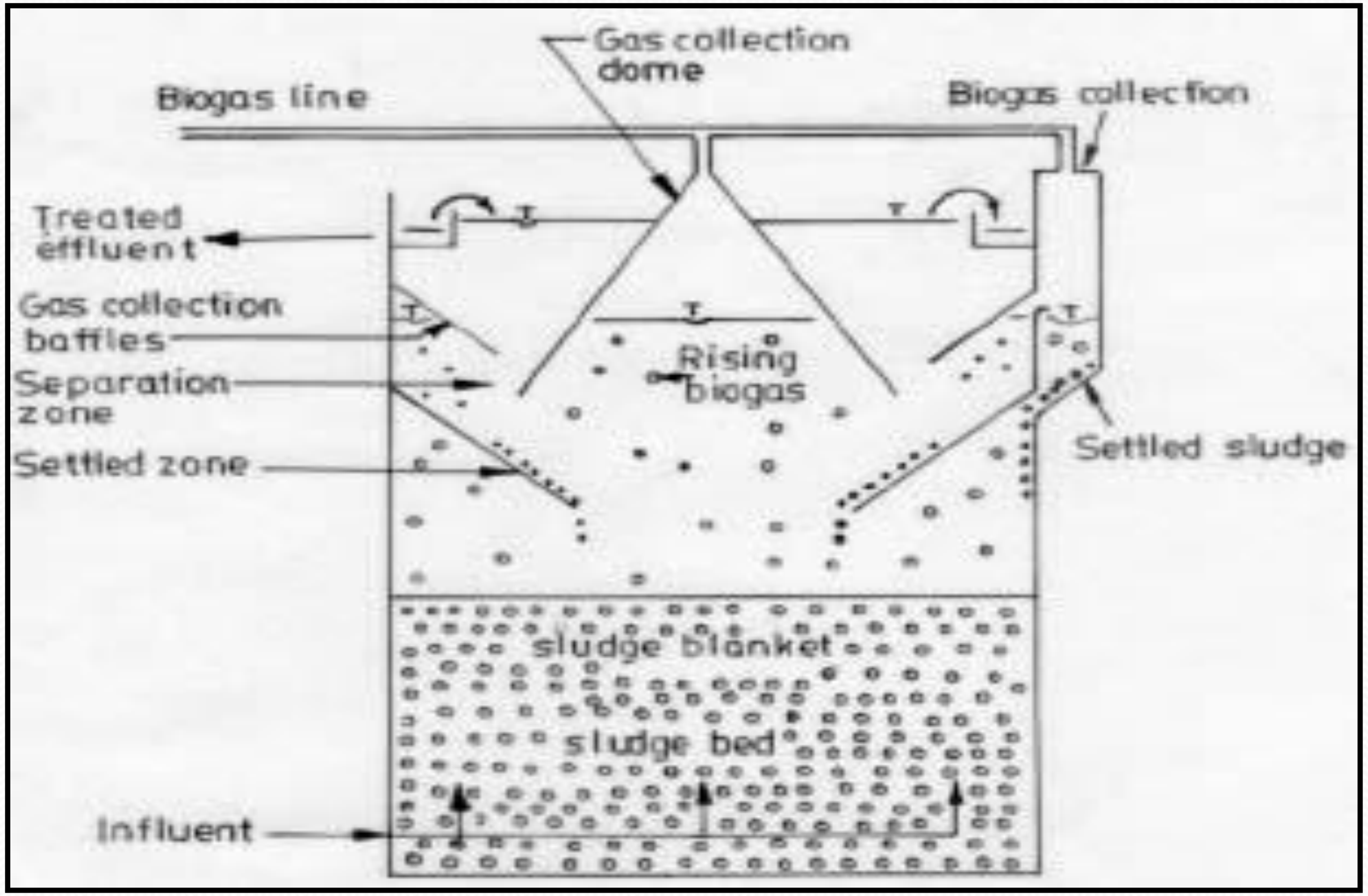
Organic materials + Nutrients/Mineral $\longrightarrow$ ***+ CO_2 +NH_3 +H_2O+CH_4+H_2S+Biomass+ End product***

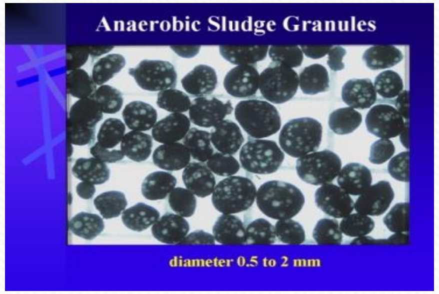
Metabolic pathway Anaerobic Digestion/Treatment



Upflow Anaerobic Sludge Blanket

- Wastewater flows upward through a sludge blanket composed of biological granules that decompose organic matter
- Some of the generated gas attaches to granules that rise and strike degassing baffles releasing the gas
- Free gas is collected by special domes
- The effluent passes into a settling chamber





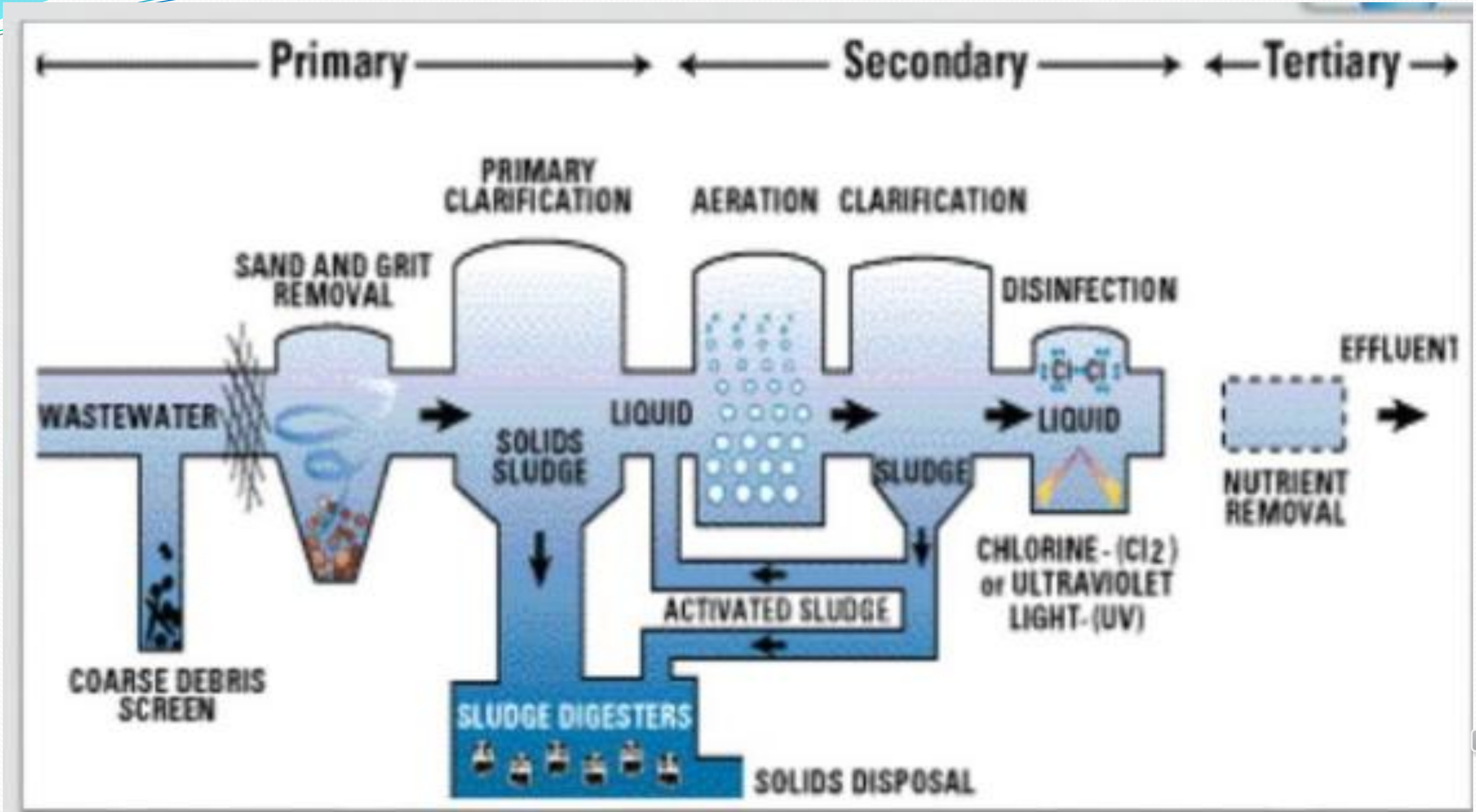
Tertiary treatment

Only 1-2 % domestic sewage receives tertiary treatment which is the most advance phase of sewage treatment. The tertiary treatment is needed under the following circumstances

- When the quality if effluent to be discharged does not meet the standard requirement.
- When there is necessity to remove dissolved solids by ION EXCHANGERS.
- To remove nitrogen and phosphorus.
- To remove pathogenic organisms through DISINFECTION.

Using chlorine gas, bleaching powder to kill the diseases causing microorganism if any

Flow sheet of wastewater treatment



Besides it, some common measures to control pollution like:

- Domestic and industrial waste waters should be discharged into rivers only after proper treatment through STPs and ETPs.
- Solid wastes must not be mixed with liquid wastes and should not be thrown into to water bodies. They should be separately managed.
- Sources of drinking water should be protected from pollution. Polluting activities (e.g., industrial use, discharging effluents, bathing, washing, cattle rearing etc.) must be avoided in vicinity of source of drinking water.
- Water bodies should be regularly cleaned of aquatic weeds, plants and other crude impurities like polythene, metals, garbage etc. Special breeds of fish, which feed on mosquito eggs and bacteria, can be cultured in water bodies.
- Afforestation must be done for reducing soil erosion and improving local soil hydrology. Use of agrochemicals need to be minimized.
- Public awareness regarding water pollution and its control measures should be created.


Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU


MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS

(Management Topic in Environmental Studies)

B. Tech 7TH semester

AIR POLLUTION

Department: Chemistry

Subject: MTES(CHM2049)

Definition

Air pollution: presence of *one or more contaminants* in such quantities and of such durations which tend to be ***injurious to human, animal or plant life, or property, or which unreasonably interferes with the comfortable enjoyment of life or property or conduct of business***.

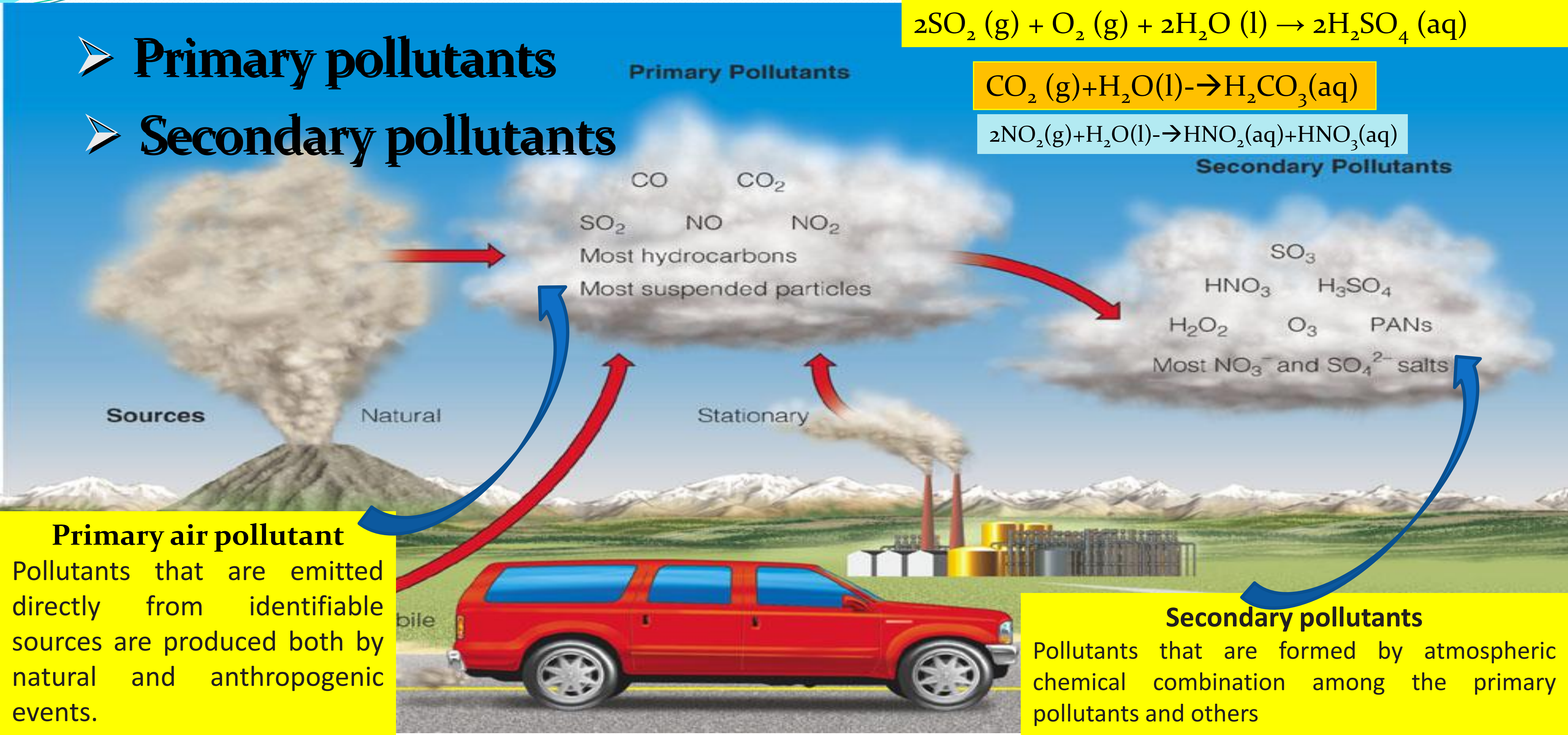
Major Classes of air pollutants

- **Primary pollutants**
- **Secondary pollutants**

$$2SO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 2H_2SO_4\,(aq)$$

$$CO_2\,(g) + H_2O(l) \rightarrow H_2CO_3(aq)$$

$$2NO_2(g) + H_2O(l) \rightarrow HNO_2(aq) + HNO_3(aq)$$

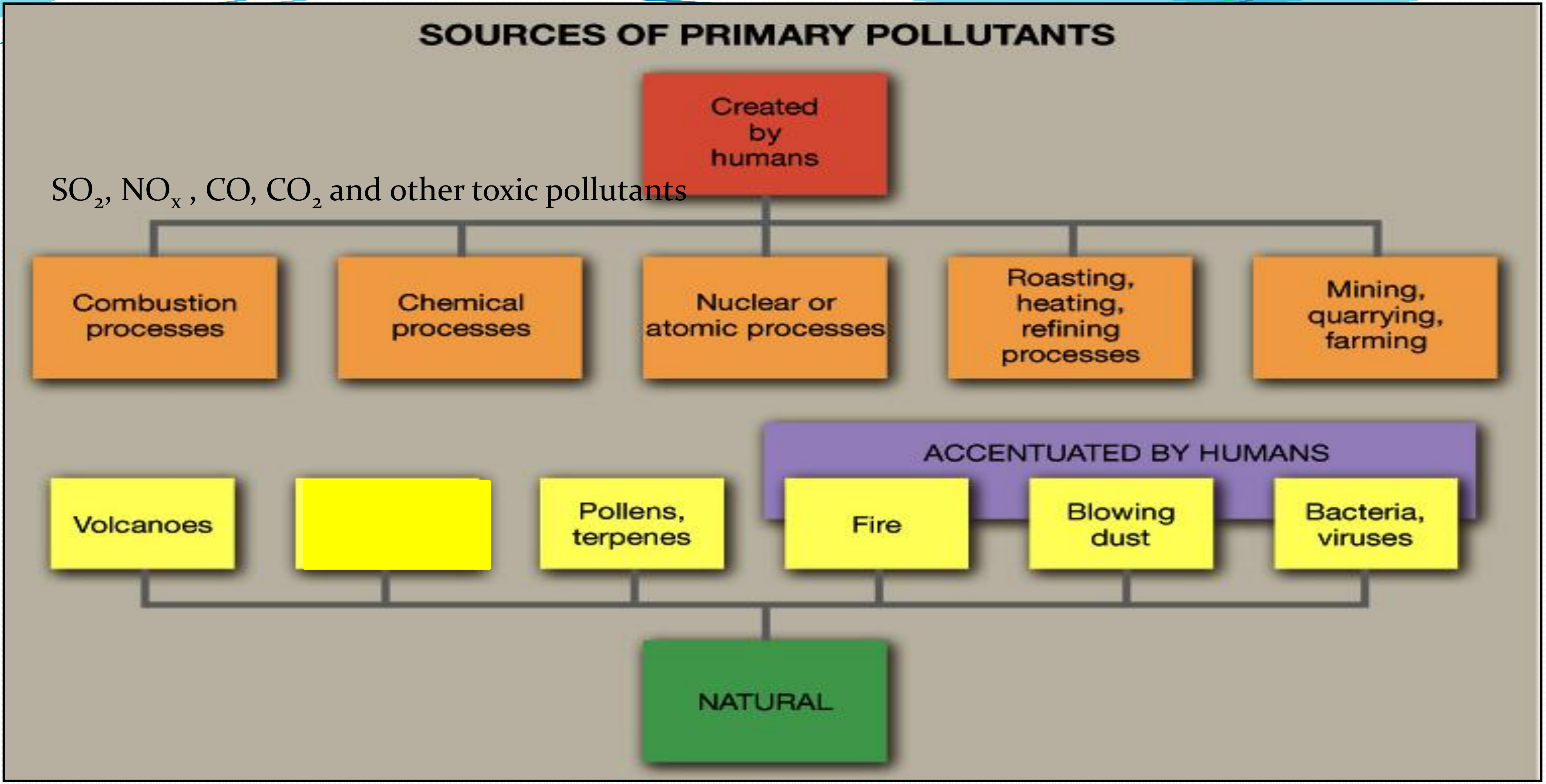


Primary air pollutant

Pollutants that are emitted directly from identifiable sources are produced both by natural and anthropogenic events.

Secondary pollutants

Pollutants that are formed by atmospheric chemical combination among the primary pollutants and others

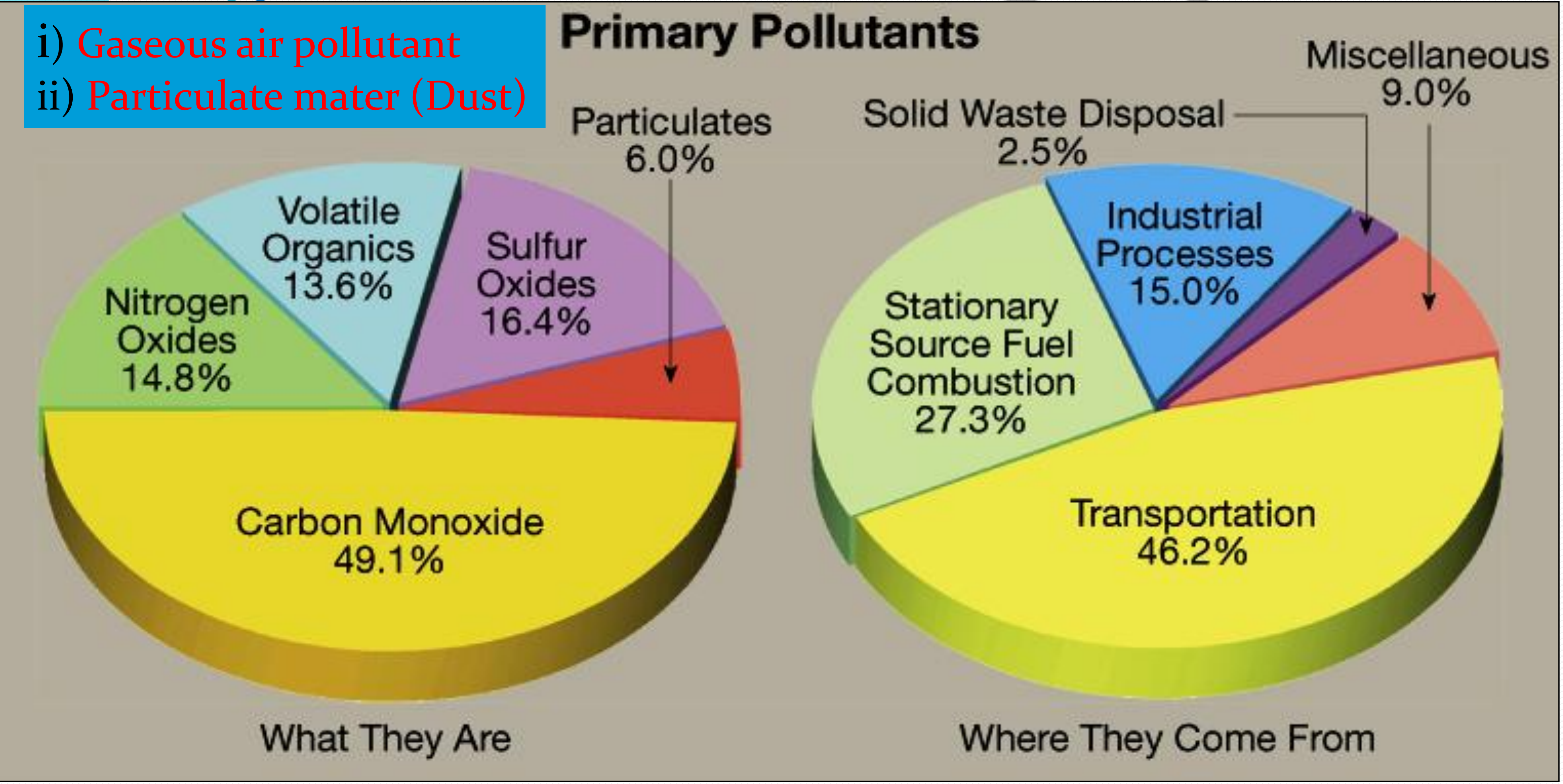


SO_2, NO_x , CO, CO_2 and other toxic pollutants

Table 1: Sources, Health and Welfare Effects for Criteria Pollutants

Pollutant	Description	Sources	Health Effects	Welfare Effects
Carbon Monoxide (CO)	Colorless, odorless gas	Motor vehicle exhaust, indoor sources include kerosene or wood burning stoves.	Headaches, reduced mental alertness, heart attack, cardiovascular diseases, impaired fetal development, death.	Contribute to the formation of smog.
Sulfur Dioxide (SO_2)	Colorless gas that dissolves in water vapor to form acid, and interact with other gases and particles in the air.	Coal-fired power plants, petroleum refineries, manufacture of sulfuric acid and smelting of ores containing sulfur.	Eye irritation, wheezing, chest tightness, shortness of breath, lung damage.	Contribute to the formation of acid rain, visibility impairment, plant and water damage, aesthetic damage.
Nitrogen Dioxide (NO_2)	Reddish brown, highly reactive gas.	Motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.	Susceptibility to respiratory infections, irritation of the lung and respiratory symptoms (e.g., cough, chest pain, difficulty breathing).	Contribute to the formation of smog, acid rain, water quality deterioration, global warming, and visibility impairment.
Ozone (O_3)	Gaseous pollutant when it is formed in the troposphere.	Vehicle exhaust and certain other fumes. Formed from other air pollutants in the presence of sunlight.	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage.	Plant and ecosystem damage.
Lead (Pb)	Metallic element	Metal refineries, lead smelters, battery manufacturers, iron and steel producers.	Anemia, high blood pressure, brain and kidney damage, neurological disorders, cancer, lowered IQ.	Affects animals and plants, affects aquatic ecosystems.
Particulate Matter (PM)	Very small particles of soot, dust, or other matter, including tiny droplets of liquids.	Diesel engines, power plants, industries, windblown dust, wood stoves.	Eye irritation, asthma, bronchitis, lung damage, cancer, heavy metal poisoning, cardiovascular effects.	Visibility impairment, atmospheric deposition, aesthetic damage.

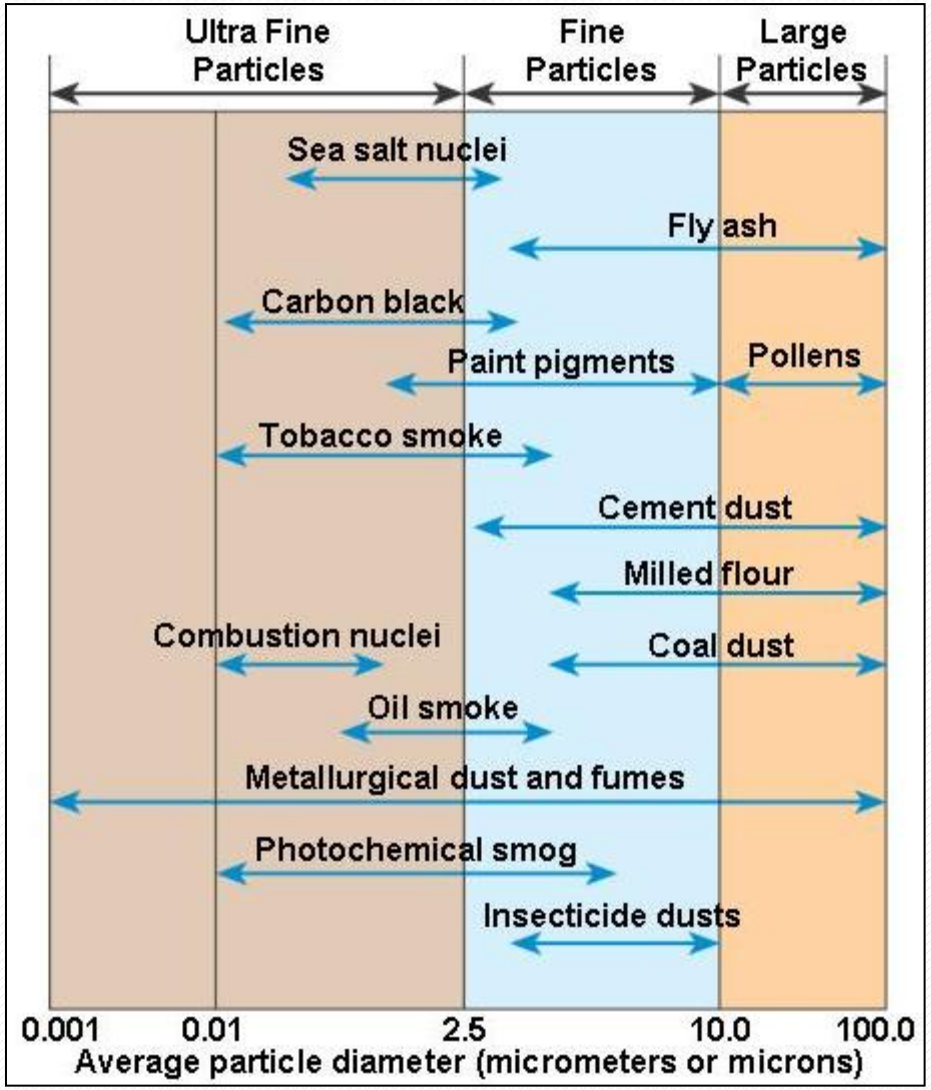
i) Gaseous air pollutant
ii) Particulate mater (Dust)



Particulate mater

Besides technical names PM10 and PM2.5, the popular names of particulate

- Mist: Aerosol consisting of liquid droplets Sulfuric acid mist
- Dust: solid particles produced from larger particles by grinding them down
- Smoke: solid particles or a mixture of solid, Cigarette smoke
- Fume: Generally means the same as smoke but often applies Zinc/lead fumes specifically to aerosols produced by condensation of hot vapors of metals.
- Fog: Aerosol consisting of water droplets



Air Quality Index (AQI) Values

TABLE 7.2 PSI VALUES AND AIR QUALITY DESCRIPTORS

PSI value	Descriptor
0–50	Good
51–100	Moderate
101–199	Unhealthful
200–299	Very unhealthful
≥300	Hazardous

TABLE 7.3 POLLUTANT STANDARDS INDEX (PSI) BREAKPOINTS

Index	1-hr O_3 $\mu g/m^3$	8-hr CO mg/m^3	24-h TSP $\mu g/m^3$	24-hr SO_2 $\mu g/m^3$	TSP × SO_2 10^3 $(\mu g/m^3)^2$
0	0	0	0	0	—
50	118	5	75	80	—
100	235	10	260	365	—
200	400	17	375	800	65
300	800	34	625	1600	261

Source: 40 CFR (Code of Federal Regulations) 58, 1982.

National Ambient Air Quality Standard (NAAQS)-2009

It was notified on 16-11-2009 by government of India. Some of the important air quality parameters are mentioned in the table

Pollutant parameter	unit	Averaging	Concentration in ambient air
			Industrial/residential area
Sulfur dioxide	$\mu g/m^3$	24 hourly	80
Nitrogen dioxide	$\mu g/m^3$	24 hourly	80
Particulate PM10	$\mu g/m^3$	24 hourly	100
Particulate PM2.5	$\mu g/m^3$	24 hourly	60
Carbon monoxide	$\mu g/m^3$	8 hourly	2000
ozone	$\mu g/m^3$	8 hourly	100

Air pollution control:

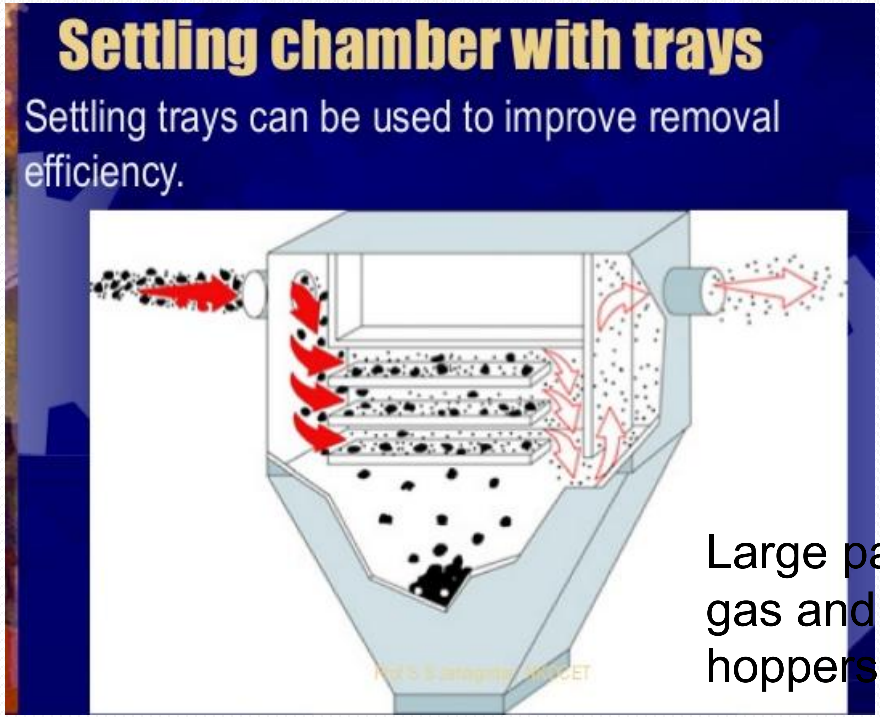
Control of Particulate matter

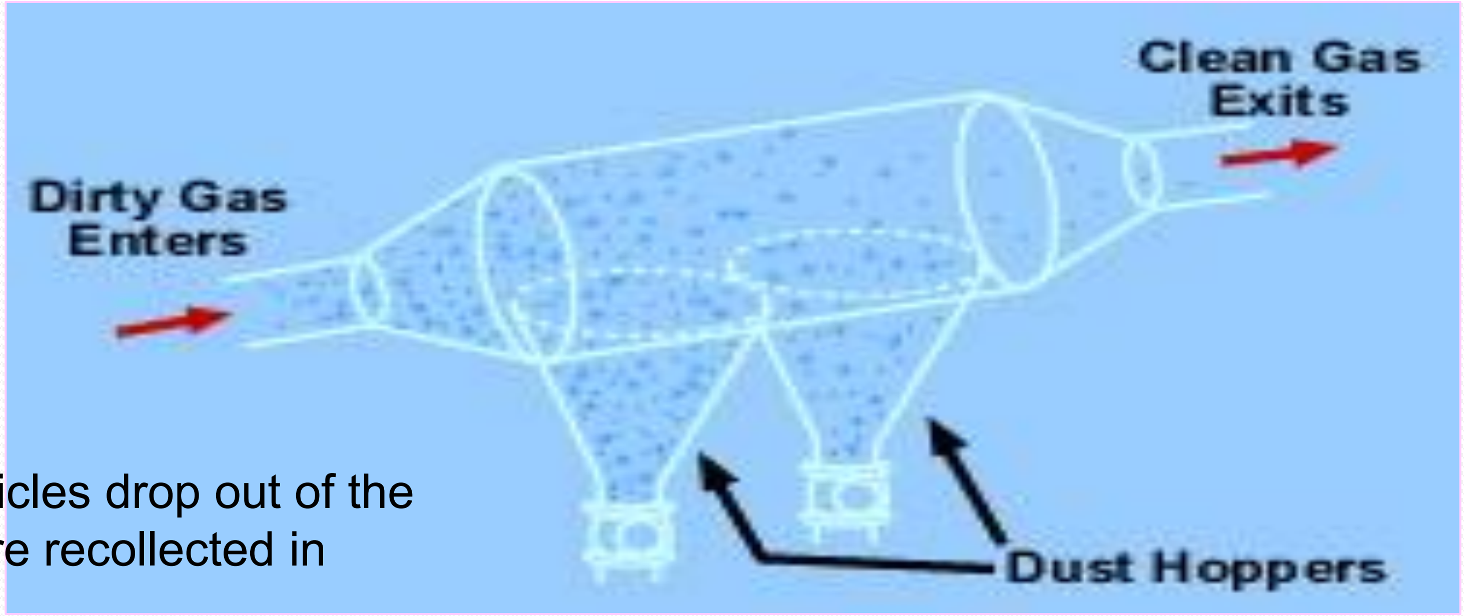
Pollution control methods	Removal mechanism	Particle size removal	efficiency	Design parameters
Gravity settling chamber	Gravity	>50 µ	>50%	-
Cyclone separator	Centrifugal forces and gravity	>5 µ	>85%	-
Bag filter	Interception, impaction and diffusion	< 0.1 µ	>99%	Air to cloth or filtering ratio 0.5 to 5 m/minute
Electrostatic precipitator (ESP)	Electrostatic forces of attraction	< 0.1 µ	>99%	

Settling Chambers

Principle: Suddenly increase in flow cross sectional area of the influent dust laden air from a to A at constant flow rate, the horizontal velocity of the particulate matter drop down from V to v when it enter in to the settling chamber (with high cross sectional area) from a pipe (small cross sectional area) thus the horizontal momentum of the Particulate matter floating in the air decreases and the gravitational force over come the horizontal momentum, as a result the particulate matter move down ward due to gravity and settled in the bottom, and clean air exhausted in the out pipe of the settling chamber

Application many tray in settling chamber increases the settling area also reduces the vertical distance facilitate settling efficiently and quickly





Large particles drop out of the gas and are recollected in hoppers

Figure: Settling chambers

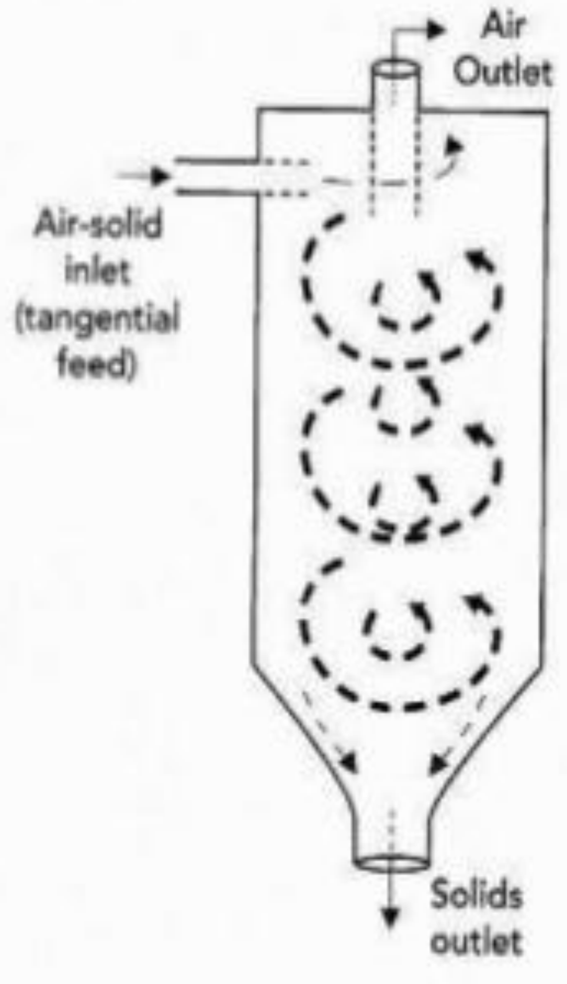
Cyclone Separator

- In a Cyclone, the air or vapor containing particulate material is forced into along the tangential axis. A helical flow pattern is set up within the chamber.

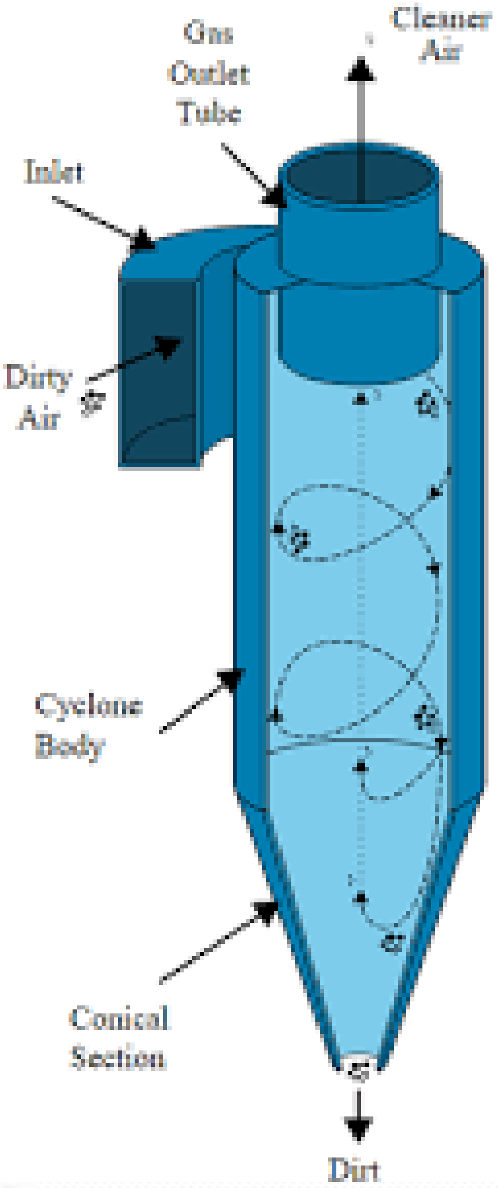
The centrifugal force causes the particles to migrate to the outside of the chamber. Here they fall down to the bottom of the cyclone by gravity.

The collected particulates are allowed to exit out an underflow pipe while the gas phase reverses its axial direction of flow and exits out through the vortex finder (gas outlet tube).

- The air moves up the center of the cyclone and reaches the top.



9.11 Flow patterns in a gas-solid cyclone separator (adapted from Geankoplis, 1983).



13.5 FABRIC FILTRATION SYSTEM

Dust laden gas is allowed to pass through the fabric bags, wherein the dust from air is filtered out allowing the clean gas to come out. The different physical mechanisms involved in the separation of dust particles from the gas stream are direct interception, inertial impaction and diffusion. After a dust mat has formed on the fabric more effective collection of submicron particle is accomplished by sieving.

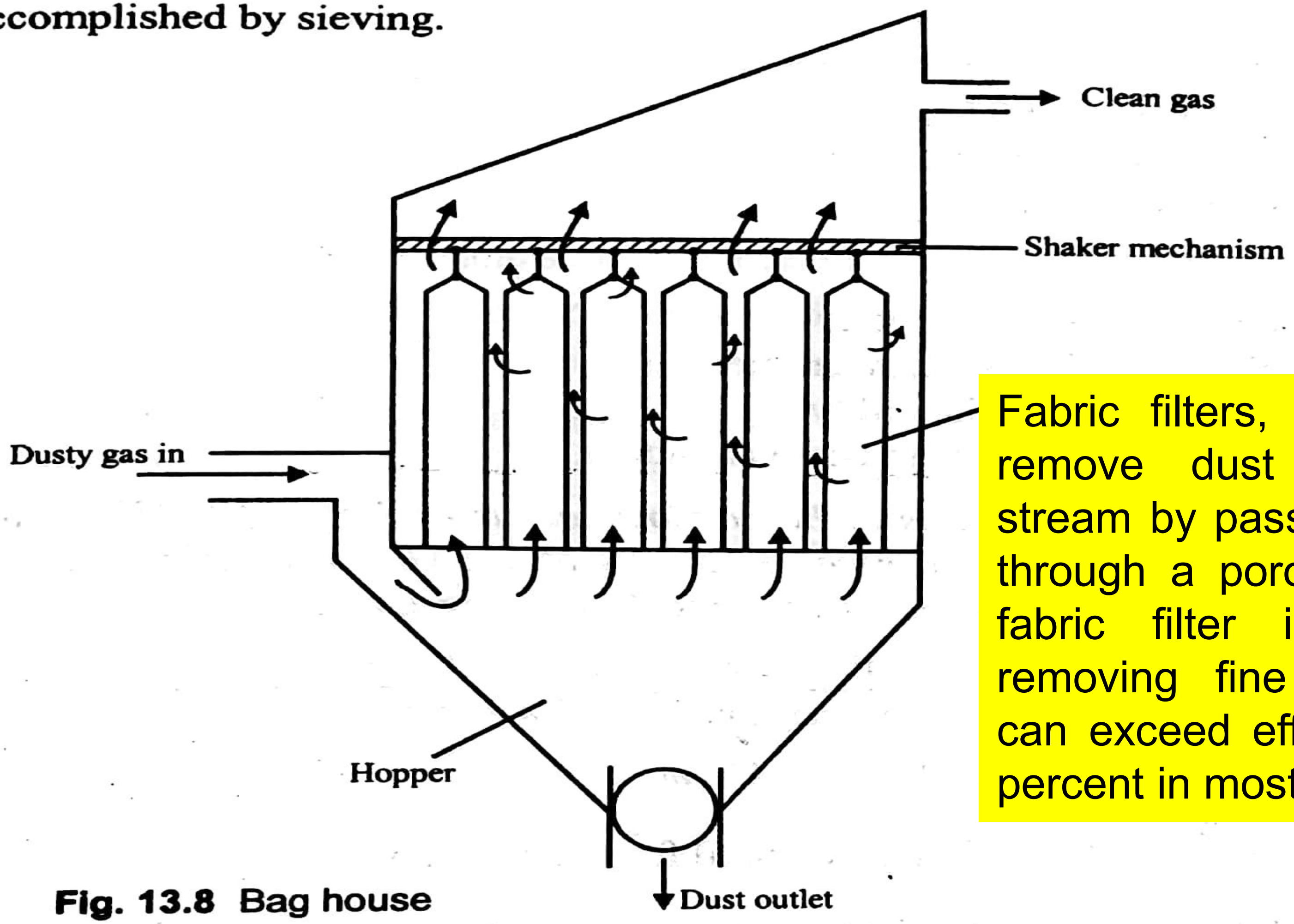


Fig. 13.8 Bag house

Fabric filters, or baghouses, remove dust from a gas stream by passing the stream through a porous fabric. The fabric filter is efficient at removing fine particles and can exceed efficiencies of 99 percent in most applications.

Filter bags are usually tubular or envelope shaped with size ranging from 1.8 to 9 m long. As particulates build up on the inside surface of the bags, the pressure drop increases, then cleaning of the bags is required. The cleaning may be accomplished by shaking the bags or by

13.6 ELECTROSTATIC PRECIPITATION (ESP)

ESP is one of the most widely used collection devices for particulates. The basic force which acts to separate the particles from the gas is electrostatic attraction. The particle-charging process is done by means of a corona surrounding a highly charged electrode such as wire. The electric field used in collecting the particles is set up between two electrodes. The dust particles collected on the plates can be removed by mechanical means like rapping (for dry collection and use of fly ash) or by washing and making the slurry to be taken to ash pond.

Four main steps in dust collection in ESP.

- Establishment of an electric field with a very high potential gradient. The central electrode is connected to the negative terminal of high DC voltage about 50 kV. Surrounding plate is maintained at +ve potential.
- Corona discharge ionisation and subseqent charging (negative) of the particulates.
- Particle migration and collection on plate with charge neutralisation.
- Particle removal - Rapping for dry collection for use.

  Washing - and making slurry for disposal in ash pond.

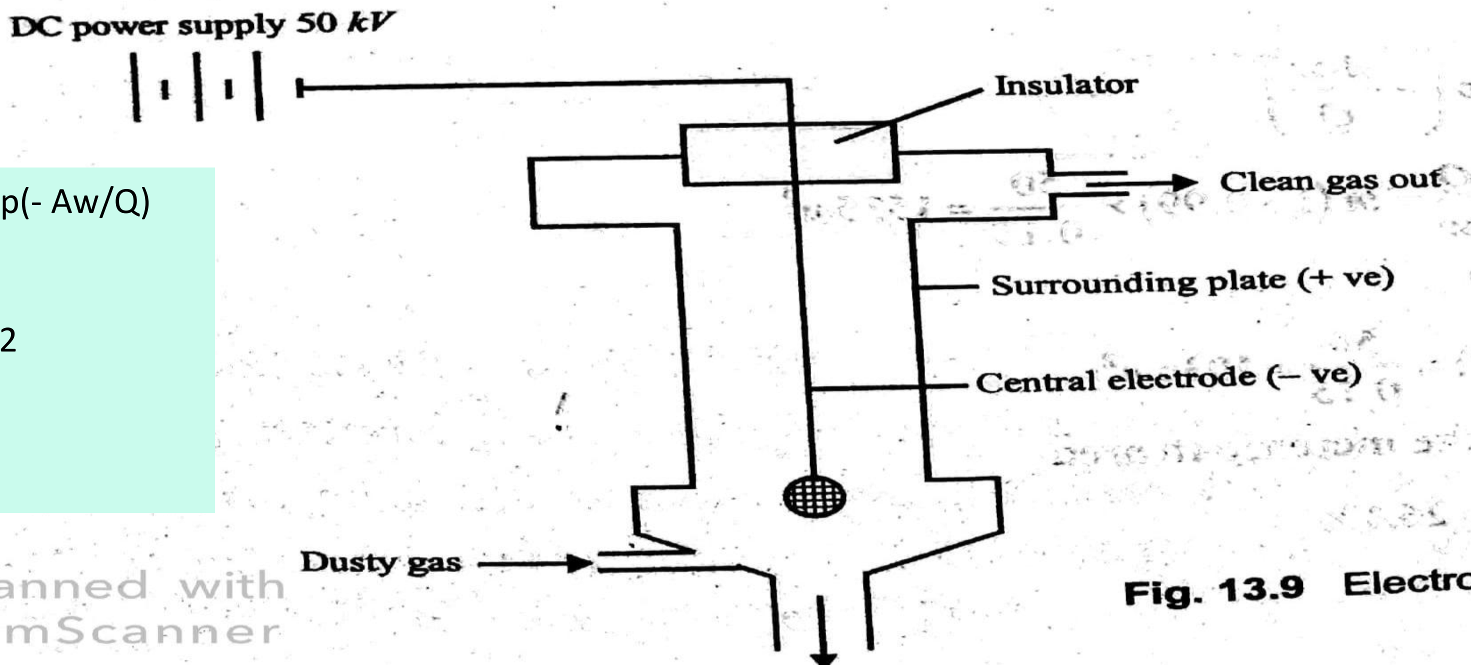


Fig. 13.9 Electrostatic precipitator

Efficiency of ESP (η) = 1- exp(- Aw/Q)

η = 0 to 1

A = Collector plate area in m2

w = particulate velocity

Q = Gas flow in m3/sec

Numerical on bag filter

Q- A bag house is to be constructed using bags of 0.25 m diameter and 6 m long. It is to receive 15 m^3/s of air. Assuming the filtration rate of 2.2 m/min. Determine the no bags required in the bag house.

Ans:-Total filtration area required= gas flow rate /filtration rate= 15x60 $m^3/min/2.2\ m/min= 409.1\ m2$

Area of one bag = pi*D*H= 3.14*0.25*6 =4.71 m^2

No of bags required in bag house= 409.1/4.71 =86.8 that is 87 bags

Numerical on ESP

Efficiency of ESP (η) = 1- exp(- Aw/Q)

η = 0 to 1

A = Collector plate area in m^2

w = particulate velocity

Q = Gas flow in m^3/sec

Compute the plate area of ESP handling a flow of 3600 m^3/min. If the particulate velocity is taken as 0.15 m/s, and efficiency of ESP as 99 %

(η) = 1- exp(- Aw/Q)

0.99 = 1- exp (0.15*A/3600/60)

A = Area of plate =1842.1 m^2

Control of gaseous pollutants from stationary sources

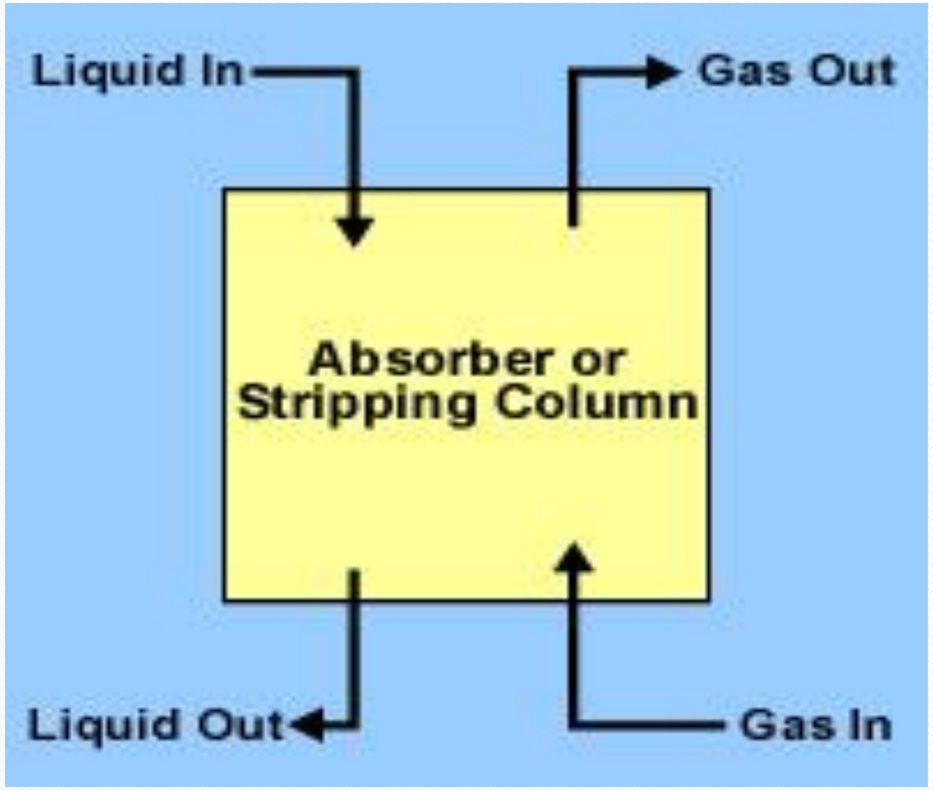
- The most common method for controlling gaseous pollutants is the addition of add-on control devices to recover or destroy a pollutant.
- There are four commonly used control technologies for gaseous pollutants:
  - Absorption,
  - Adsorption,
  - Condensation, and
  - Incineration (combustion)

Absorption

Absorption: involves transfer of pollutant from gas stream to liquid stream. Examples are removal of ammonia by water, hydrogen sulphide by sodium hydroxide etc.

- Absorption is a process in which a **gaseous pollutant is dissolved in a liquid**.

Absorbers are often referred to as **scrubbers**,



Typical Packed Column Diagram

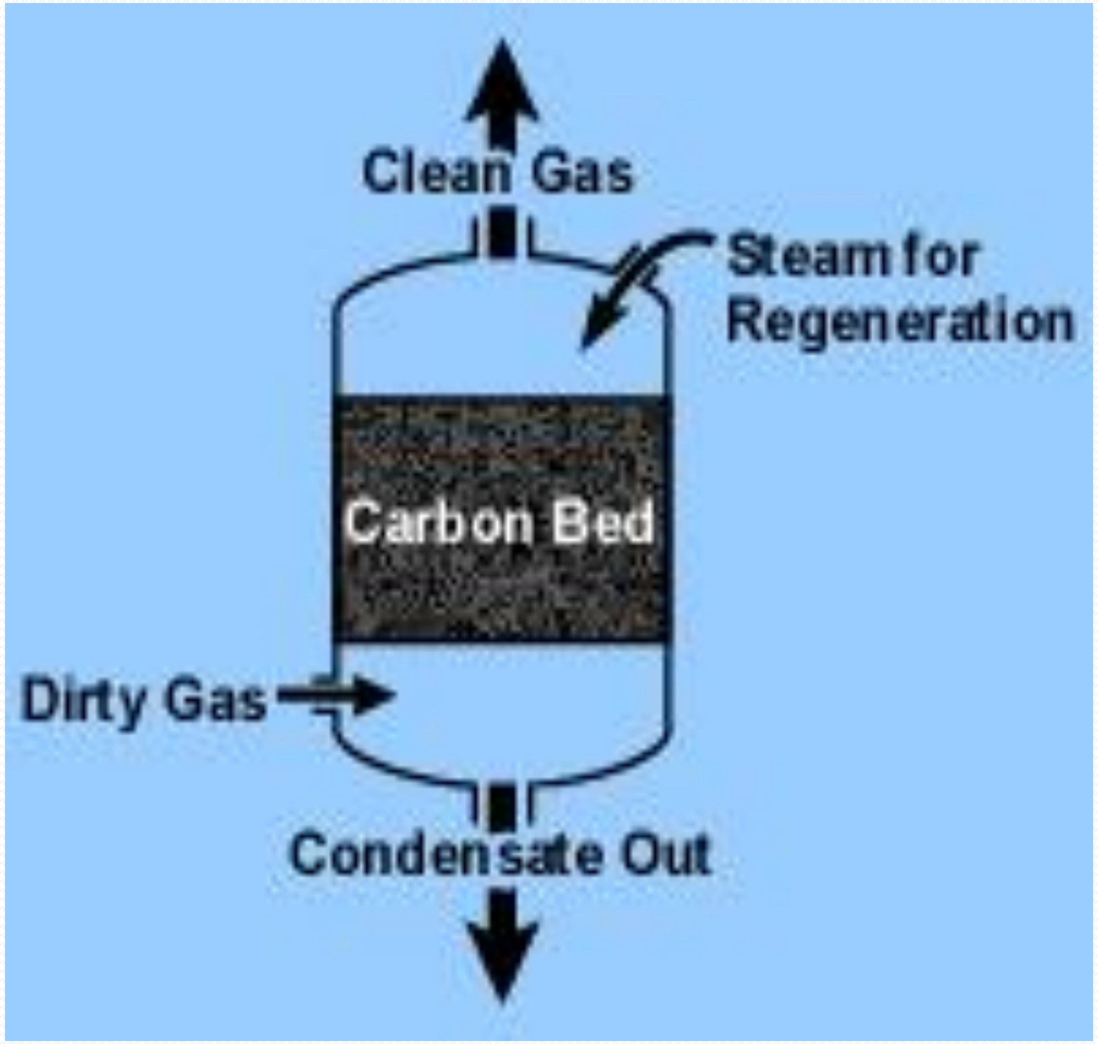
In general, absorbers can achieve removal efficiencies grater than **95 percent**.

One potential problem with absorption is the generation of waste-water, which converts an air pollution problem to a water pollution

Adsorption

Adsorption involves transfer of pollutant from gas or liquid stream to solid surfaces having desirable surface properties.

- The most common industrial adsorbents are;
- **Activated carbon**
- **Silica gel**
- **Alumina**,
- because they have enormous surface areas per unit weight.



Incineration

- Incineration, also known as combustion, is most used to control the emissions of organic compounds from process industries.
- This control technique refers to the rapid oxidation of a substance through the combination of oxygen with a combustible material in the presence of heat.
- When combustion is complete, the gaseous stream is converted to carbon dioxide and water vapor.
- Equipment used to control waste gases by combustion can be divided in three categories:
  - Direct combustion or flaring,
  - Thermal incineration and
  - Catalytic incineration.
  - 3T= Temperature, Time, and turbulence


Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU


MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS

(Management Topic in Environmental Studies)

B. Tech 7TH Semester

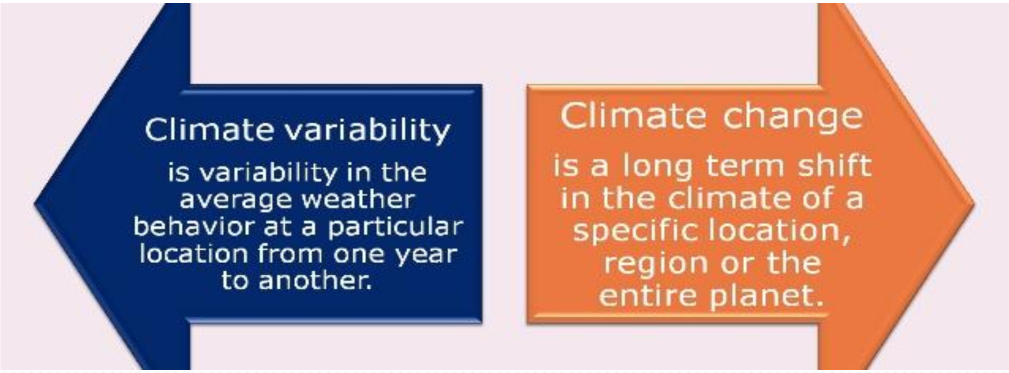
Global Warming and Climate change

Department: Chemistry
Subject: MTES (CHM 2049)

Contents

DEFINITION OF GLOBAL WARMING AND CLIMATE CHANGE

Global Warming	Climate Change
➢ Refers to temperature increase in the troposphere.	➢ Refers to changes in any aspects of the earth's climate including temperature, precipitation and storm intensity and patterns.
➢ An increase in Earth's average surface temperature due to rising level of greenhouse gases.	➢ A long-term change in the Earth's climate, or of a region on Earth.



Causes of Climate Change

Feedback Mechanisms

Anthropogenic Global Warming

Bio-thermostat

Variations in Solar Radiation

- **Solar Irradiance**
- **Sunspot Activity**
- **Earth-Sun Geometry (Milankovitch cycles)**
- **Atmospheric Dust and Volcanoes**

Distribution of Continents

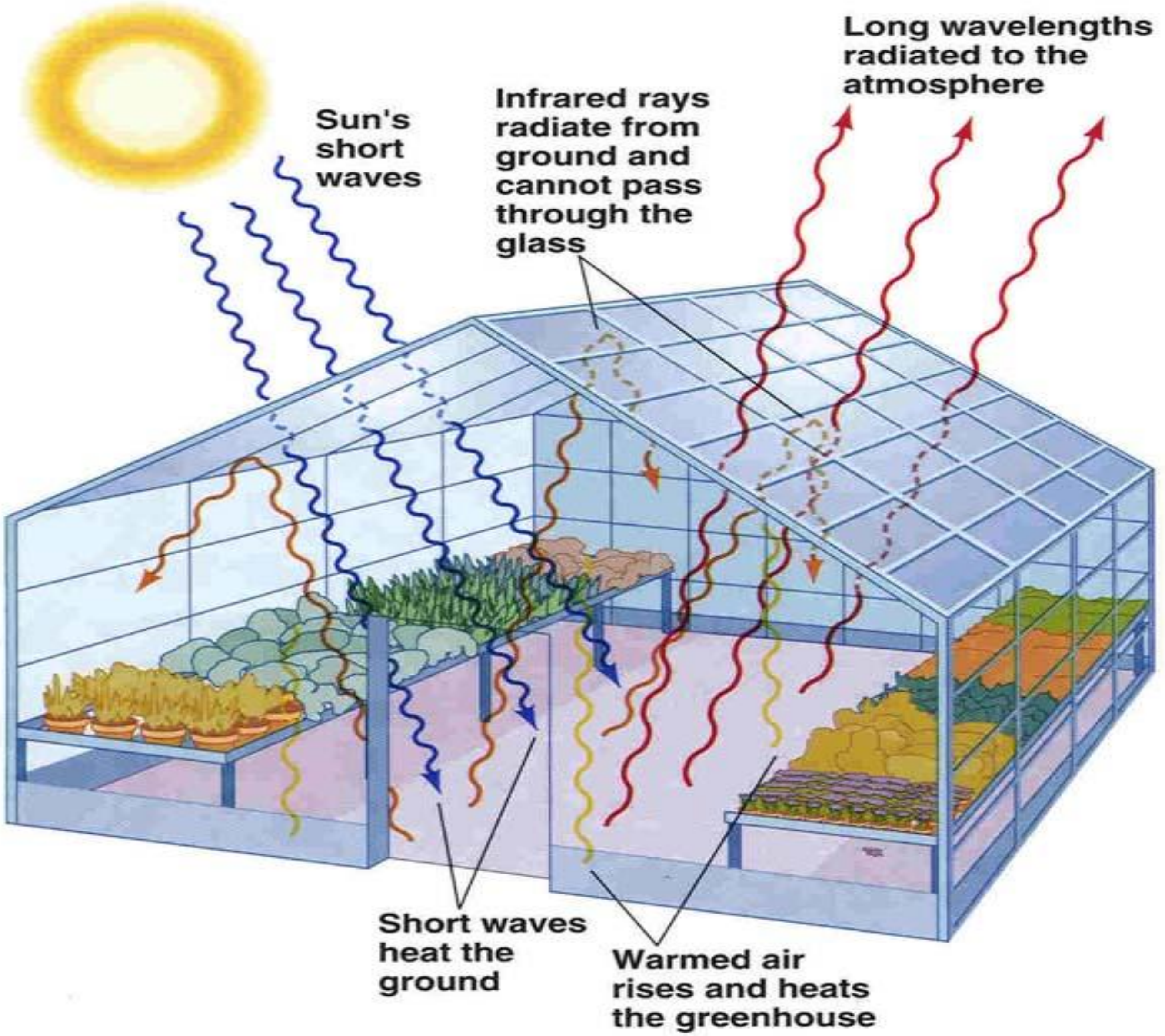
- **Plate Tectonics**
- **Mountain Building**

Ocean Variation

- **Thermohaline Circulation**

Anthropogenic Global Warming

Principle of Green House Gases ?



Type and sources Greenhouse Gases

High Conc.
- H_2O = 1-3%
- CO_2 = .035%

Trace
- CH_4
- N_2O
- O_3
- CFC's

Naturally occurring

Anthropogenic

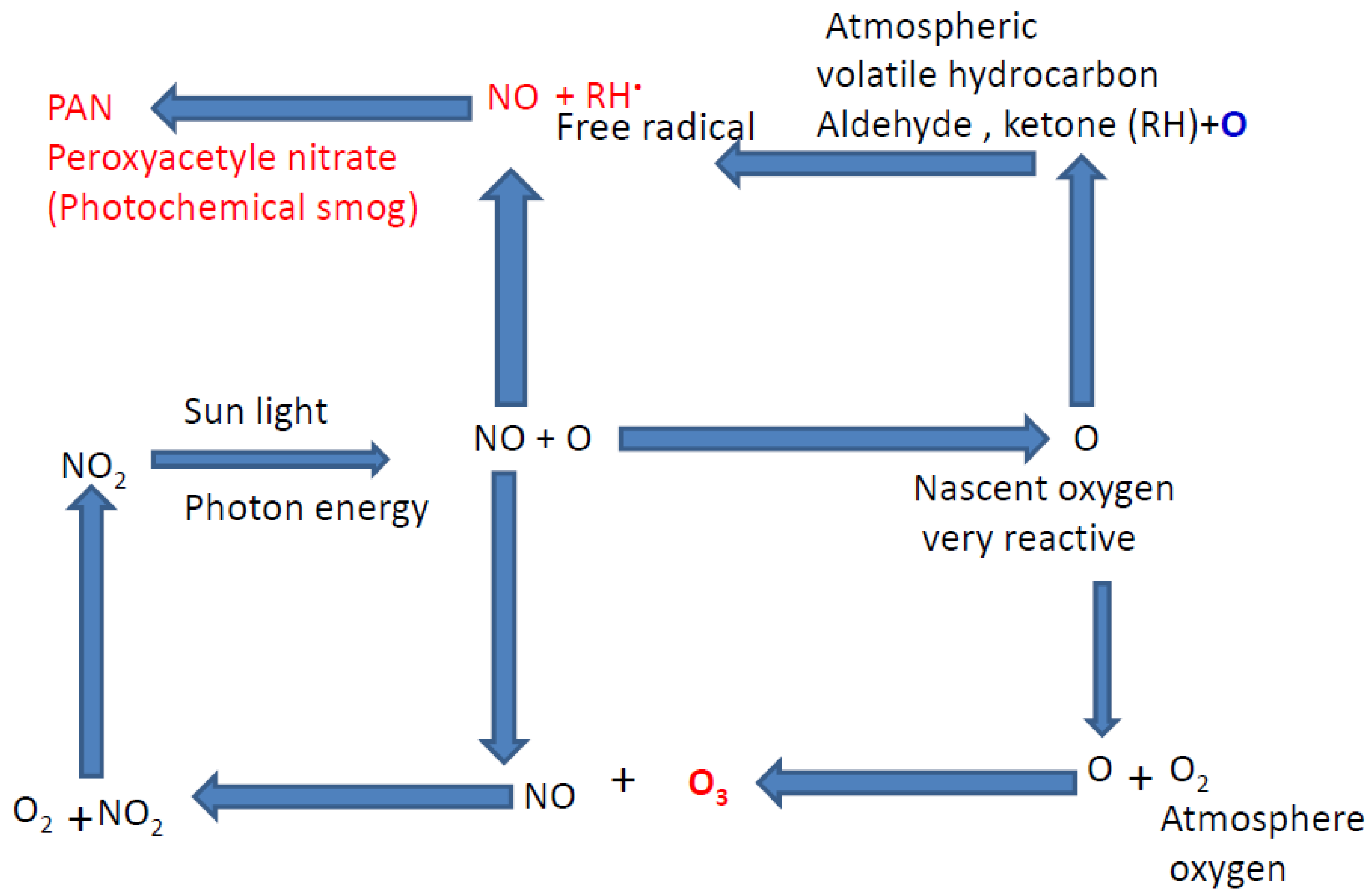
Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

Sources of ozone

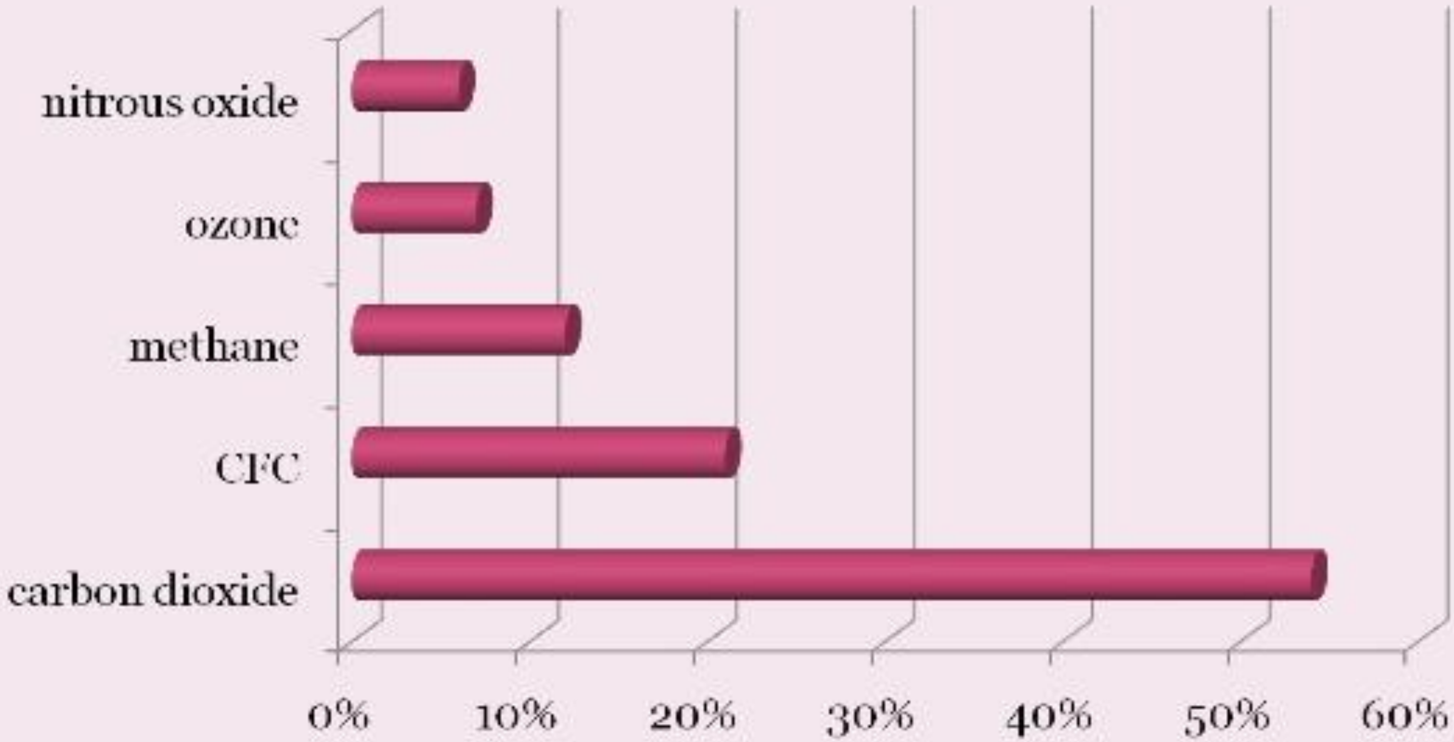
Sources of Green house gases

Carbon dioxide (CO2)- **burning fossil fuels and wood.**
Nitrous oxide (NO2)- **fertilizer use and decomposition of animal wastes.**
Methane (CH4)- **sediments, swamps, landfills, and in flooded rice paddies.**
Chlorofluorocarbons (CFCs)- **Freon (a refrigerant)**
Halons, such as halocarbons- **fire extinguishers.**
Water vapor – **clouds reradiate heat back to Earth**

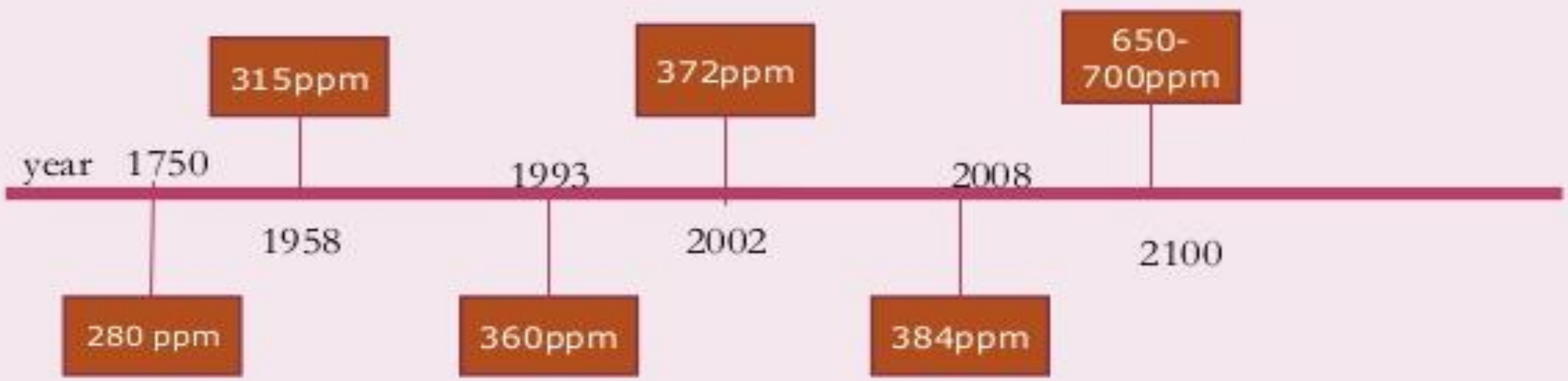
Photochemical Smog and formation of ground level Ozone



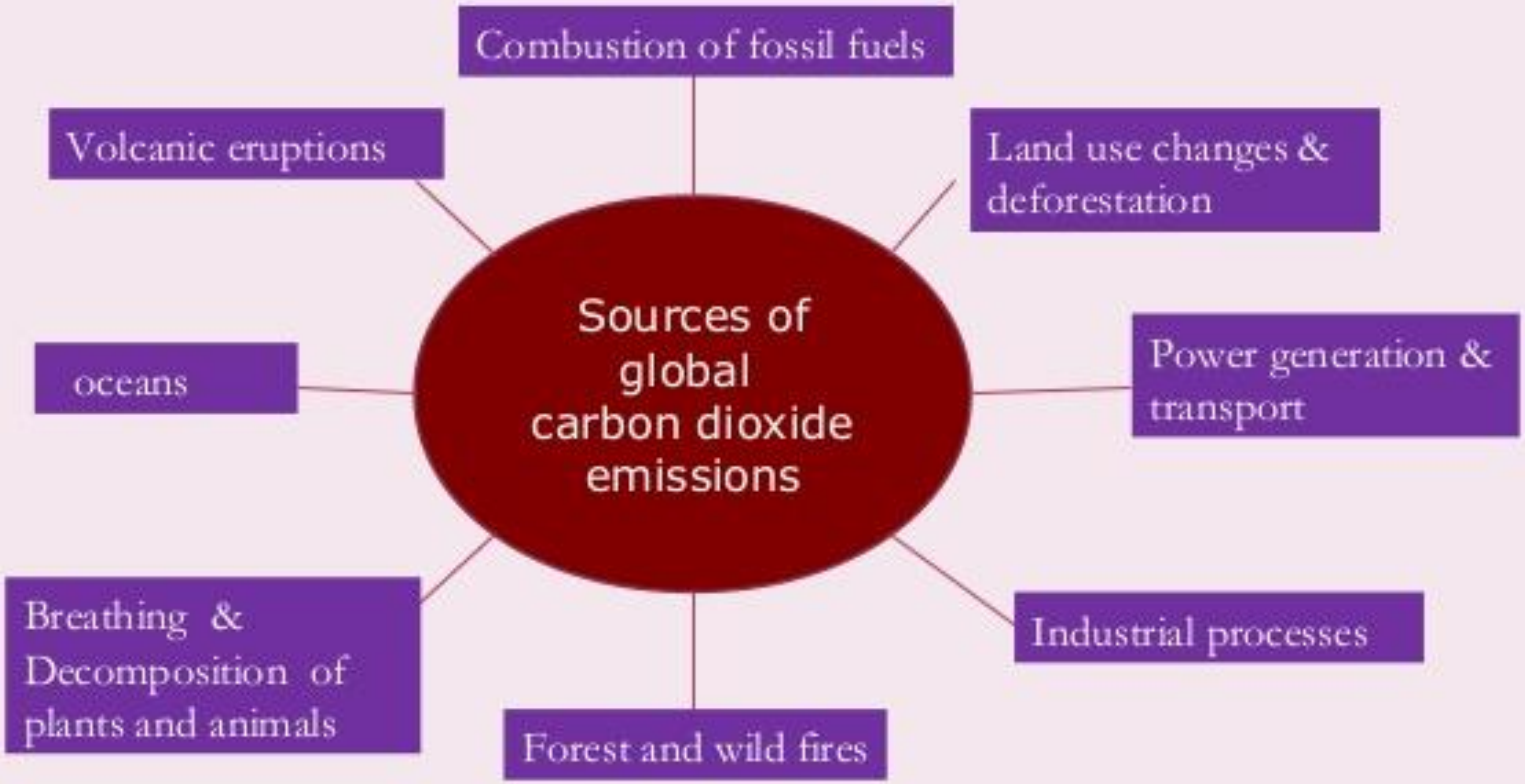
Percent share of greenhouse gases



Time line of global carbon dioxide levels

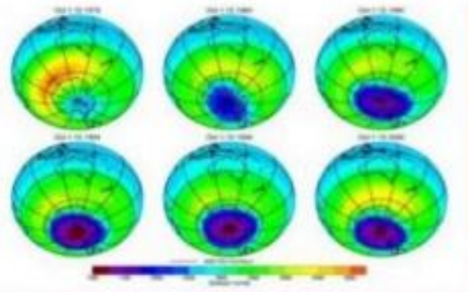


Sources of global carbon dioxide emissions



Depletion of Stratospheric Ozone and Climate change

- Ozone (Greek *ozein*, "to smell"), pale blue, highly poisonous gas with a strong odor
- **The tropospheric ozone**(lower atmosphere) is considered a pollutant at ground level,
- **The stratospheric ozone** (upper atmosphere) is called 'the ozone shield'.
- Chlorine reactions deplete ozone in the stratosphere.
- **Ozone depleting gases** are CFC, halons, nitrous oxide, methane, carbon tetrachloride and methyl chloroform.



Ozone depletion results in 'ozone hole' in upper atmosphere. During the 1980s, scientists discovered a "hole" in the ozone over Antarctica.

- **Ozone depletion leads to more UV radiation - skin cancer and cataracts and depression of the immune system.**
- **Each 1% drop in ozone is thought to increase human skin cancer rates by 4-6%.**

Impact of Global Worming

National Oceanic and Atmospheric Administration-*Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC) 2007*

- **Earth's average surface temperature has increased by more than 1.4°F (0.8°C) over the past 100 years**
- By the end of the 21st century, **carbon dioxide concentration** will increase from 490 to 1260 ppm.
- **Global mean sea level** has been rising at an average rate of 1.7 mm/year over the past 100 years. Global sea level rose about 17 cms in the last century
- Both the extent and thickness of **Arctic sea ice** has declined rapidly over the last several decades. The Greenland and Antarctic ice sheets have decreased in mass.
- **Glaciers and ice caps** are retreating everywhere around the world —in the Alps, Himalayas, Andes, Rockies, Alaska and Africa.
- Since the beginning of the Industrial Revolution, **the acidity of surface ocean waters** has increased by about 30 percent.

Influence amount and pattern of precipitation, Drought

Impact of Global warming

1. Frequent temperature extremes (killer heat waves).
2. Changing rainfall patterns.
3. Rise in sea levels.
4. Frequent storms and coastal flooding
5. Changes in regional climate could alter forests, crop yields, and water supplies
6. Drought
7. Food shortages due to shift in agricultural food production
8. Greater warming near the poles
9. Air pollution made worse by warming.
10. Asthma, bronchitis, emphysema complications
11. Expansion of Deserts into existing rangelands.
12. Unable to contain spread of infectious diseases

IMPACT OF GLOBAL WARMING

2009 Indian floods

The 2009 India floods affected various states of India in July 2009. The most affected states were Karnataka, Orissa, Kerala, Gujarat and North-East Indian states, with over 200 people reported dead, and a million homes destroyed.

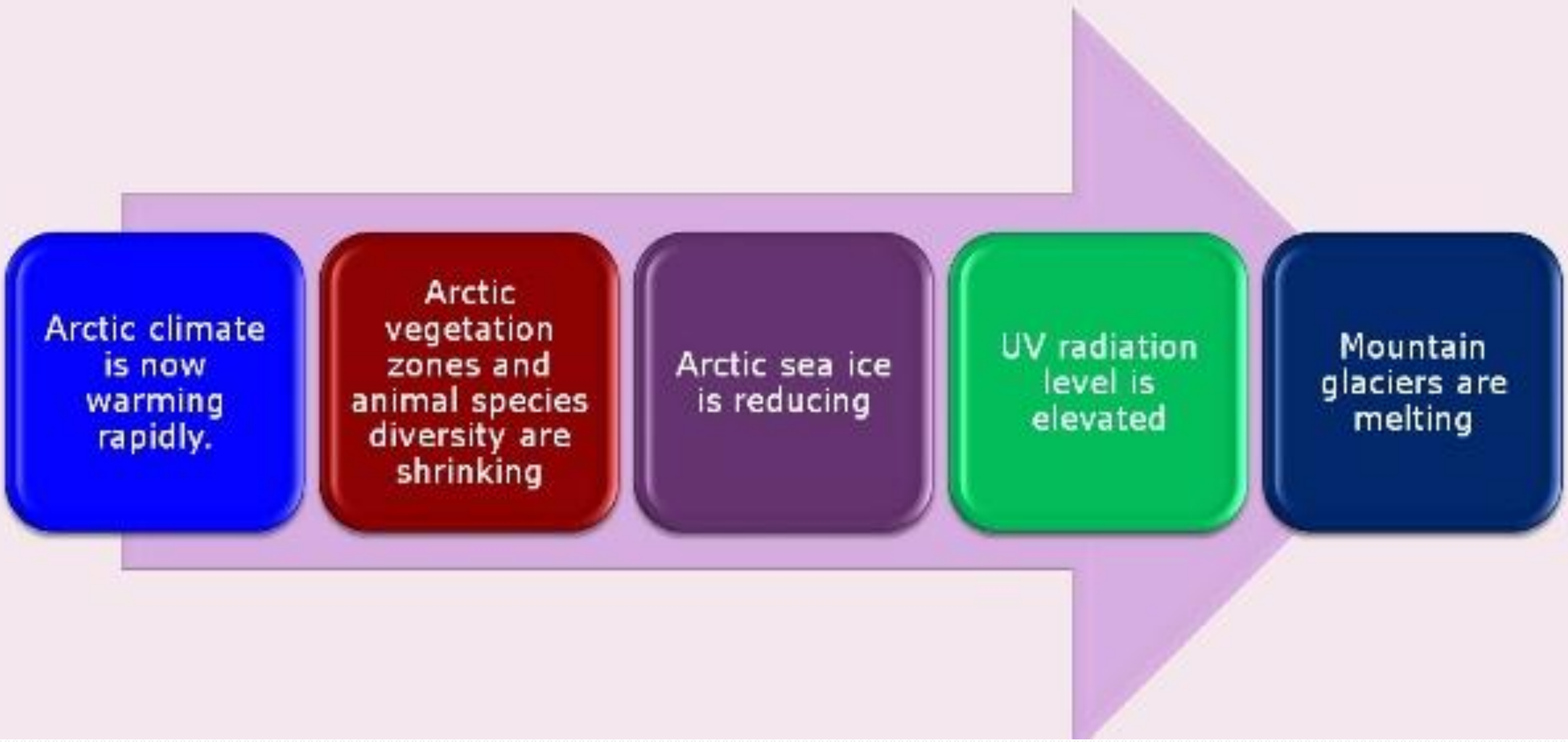
CAUSING BAD THINGS

- 2002, Colorado, Arizona and Oregon endured worst wildfire seasons ever
- dust storms in Montana, Colorado and Kansas
- floods hundreds of millions of dollars in damage in Texas, Montana and North Dakota
- snow accumulation has declined 60
- winter seasons shortened in Cascade Range in Oregon and Washington

- **According to WHO, malaria, diarrhea, malnutrition and floods related to climate change cause about 150,000 worldwide deaths.**
- **IPCC reported 250 million more Africans are without potable water due to climate related stress.**
- **Flooding linked to rising sea levels displaced millions of people.**

Evidences of climate change :

Arctic climate impact assessment (ACIA, 2004)



Mitigation of Global Warming

- Conservation
  - Reduce energy needs
  - Recycling
- Alternate energy sources
  - Nuclear
  - Wind
  - Geothermal
  - Hydroelectric
  - Solar
  - Fusion?

- ➢ Use less heat and air conditioning
- ➢ Drive less and drive smart
- ➢ Factory install smoke filters
- ➢ Plant a tree
- ➢ Vehicles use unleaded petrol
- ➢ Enforce the law on behalf of polluting the environment
- ➢ Environmental campaign

HOW CAN WE CUT GLOBAL WARMING POLLUTION

put existing technologies for building, cleaner cars and

reducing pollution from vehicles and power plants Hybrid gas-electric engines

renewable energy sources such as wind, sun and geothermal

manufacture more efficient appliances and conserve energy

more modern electricity generators into widespread use

Three 60 Watt Bulbs

DO TO HELP FIGHT GLOBAL WARMING

choose a compact fluorescent light bulb over an incandescent bulb

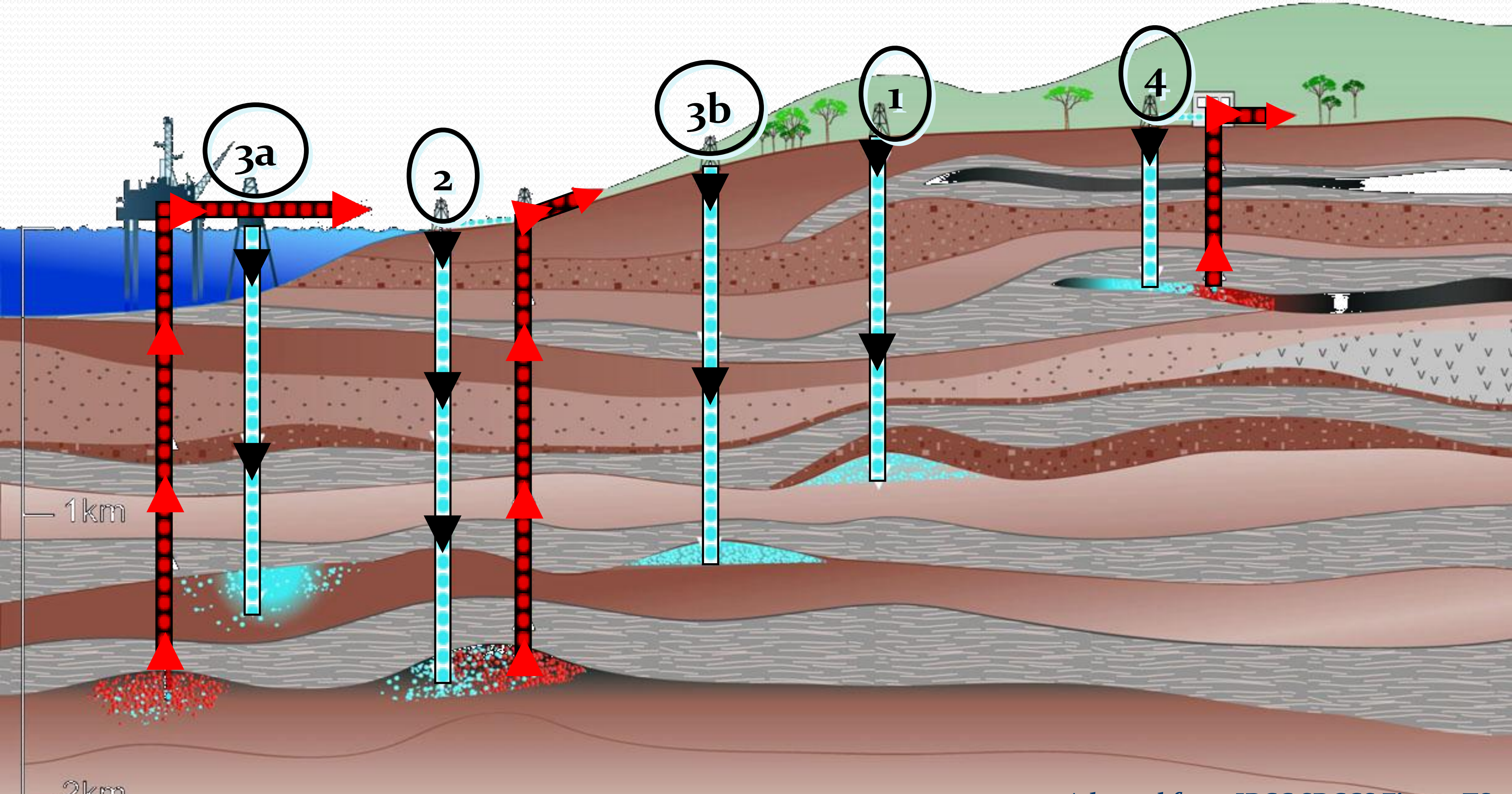
fluorescent light bulb

opting for a refrigerator with the Energy Star label

refrigerator

Storage of CO_2 in Geological Formations

1. Depleted oil and gas reservoirs
2. CO_2 in enhanced oil and gas recovery
3. CO_2 in enhanced coal bed methane recovery



Adapted from IPCC SRCCS Figure TS-7


Measure consumption of environmental resources
Calculate emissions
Reduce emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU


MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS

(Management Topic in Environmental St

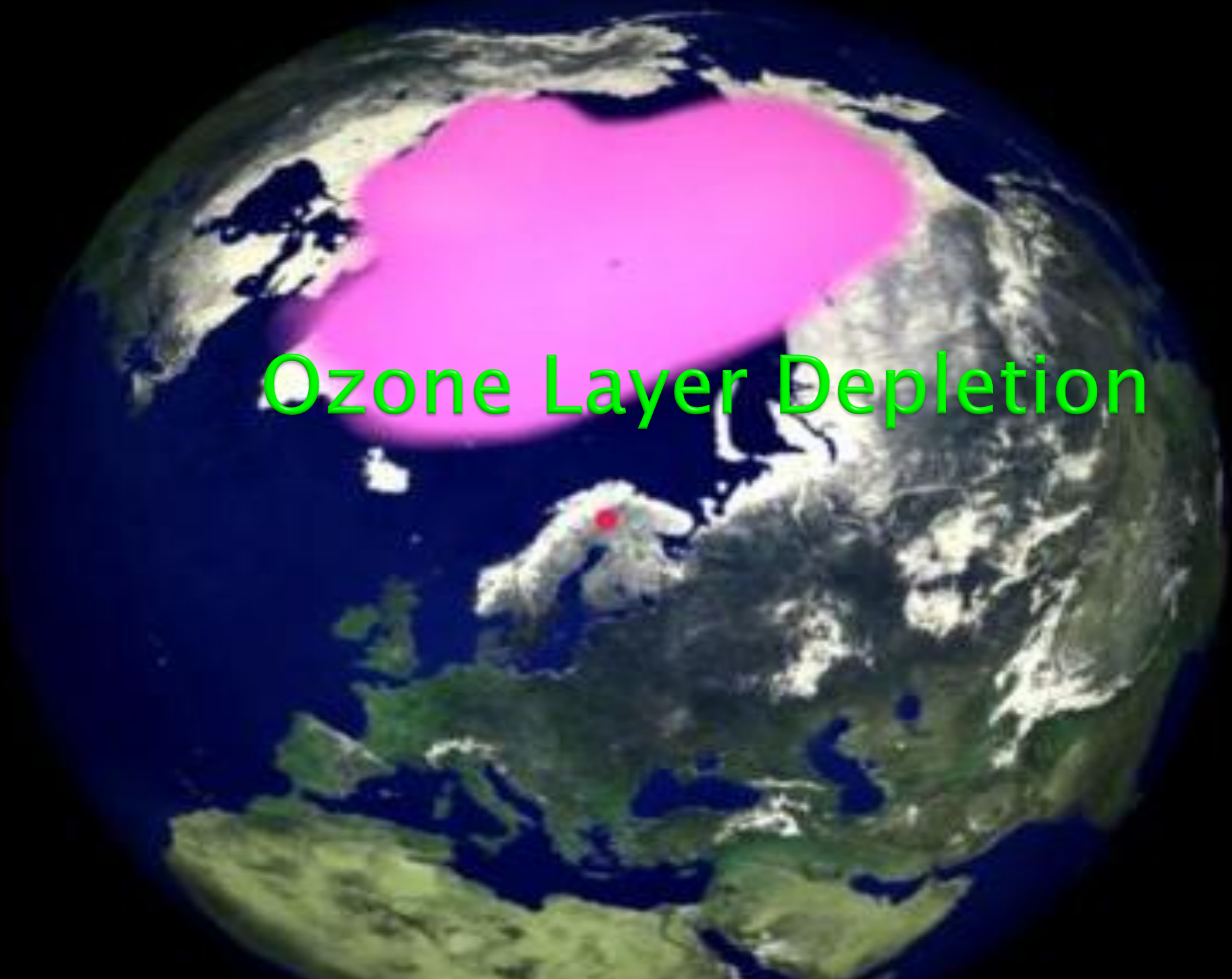
B. Tech 7TH Semester

Ozone Layer Depletion and Acid Rain

Depart: Chemistry

Subject: MTES (CHM 2049)

Ozone Layer Depletion



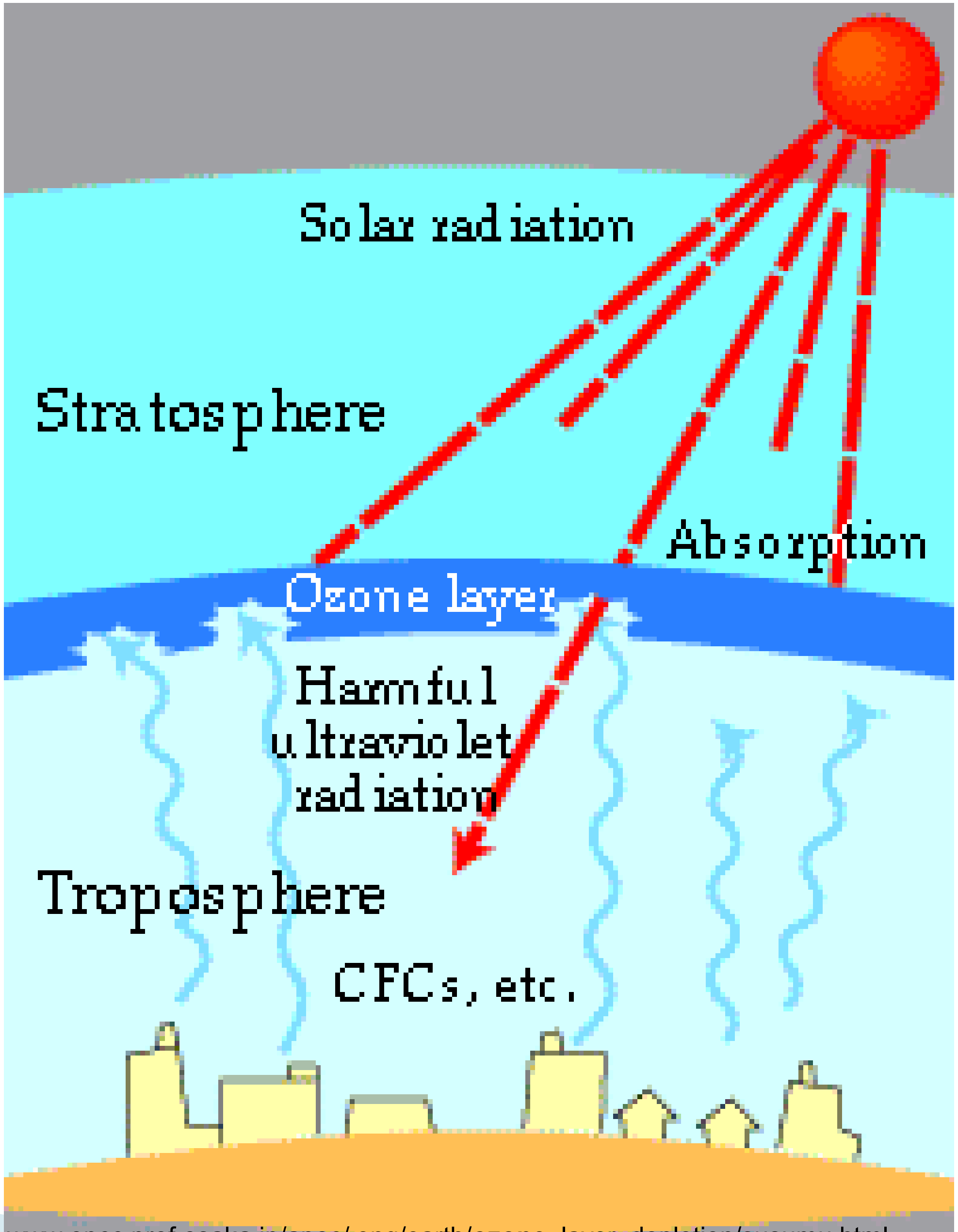
Content

- Introduction to ozone
- Types of ozone depleting chemicals
- Mechanism of Ozone depletion
- Chapman cycle
- Impact of Ozone depletion
- Preventive measure

Introduction to Ozone

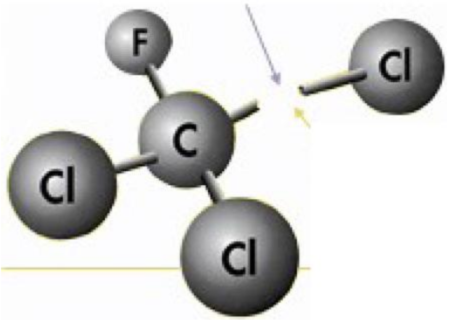
The ozone layer

- Ozone is a triatomic form of oxygen (O_3) found in Earth's upper and lower atmosphere.
- The ozone layer, situated in the stratosphere about 15 to 30 km above the earth's surface.
- Ozone protects living organisms by absorbing harmful ultraviolet radiation (UVB) from the sun.
- The ozone layer is being destroyed by CFCs and other substances.



www.epcc.pref.osaka.jp/apec/ eng/earth/**ozone**_layer_depletion/susumu.html

What is CFCs?



- Chlorofluorocarbons (CFCs)
- Composed of elements chlorine, fluorine, and carbon
- CFCs were welcomed by industries:
  - Low toxicity
  - Chemical stability
  - Cheap
- Usage:
  - As refrigerants. Air conditioning
  - As cleaning agents
  - As propellants

CFCs are used in aerosol sprays

CFC-11 (trichlorofluoromethane - $CFCl_3$),
CFC-12 (dichloro-difluoromethane - CF_2Cl_2),
CFC-113 (trichloro-trifluoroethane - $C_2F_3Cl_3$),
CFC-114 (dichloro-tetrfluoroethane $C_2F_4Cl_2$),
CFC-115 (chloropentafluoroethane - C_2F_5Cl)

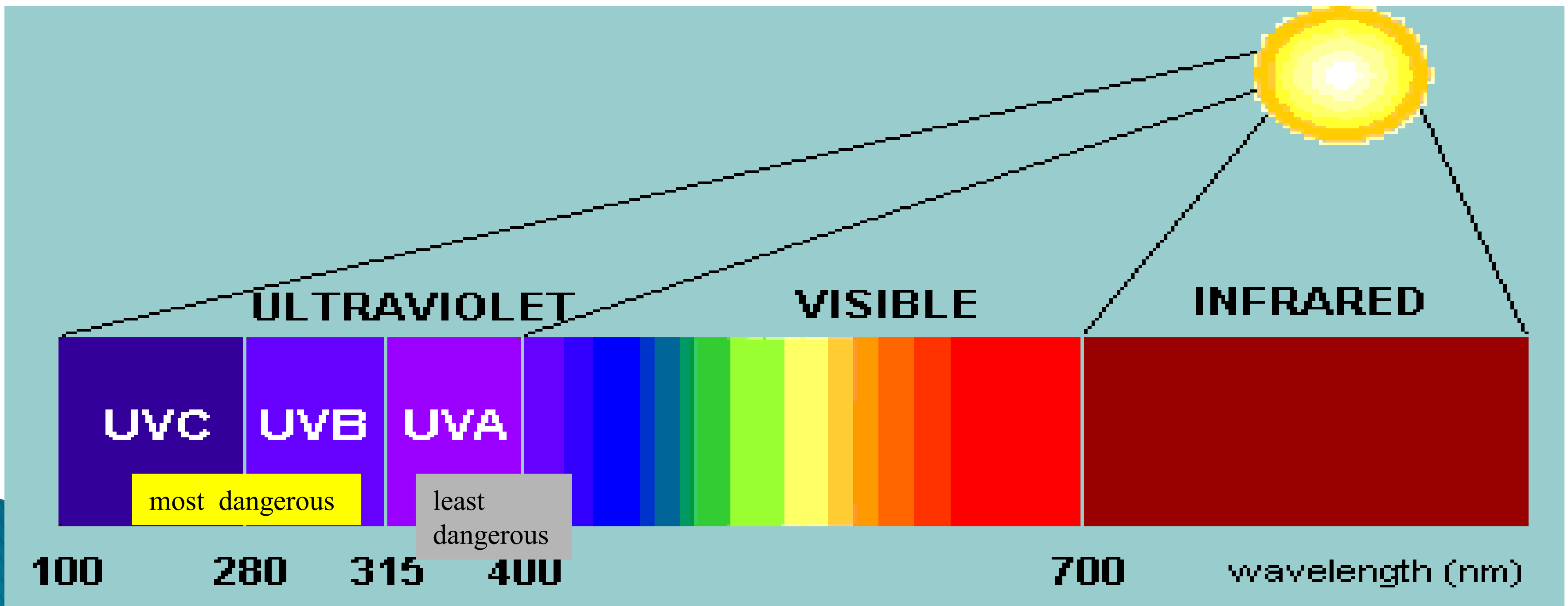
Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

Halon
CH_3CCl_3 (Methyl chloroform)
CCl_4 (Carbon tetrachloride)
Chlorofluorocarbons
Methyl bromide

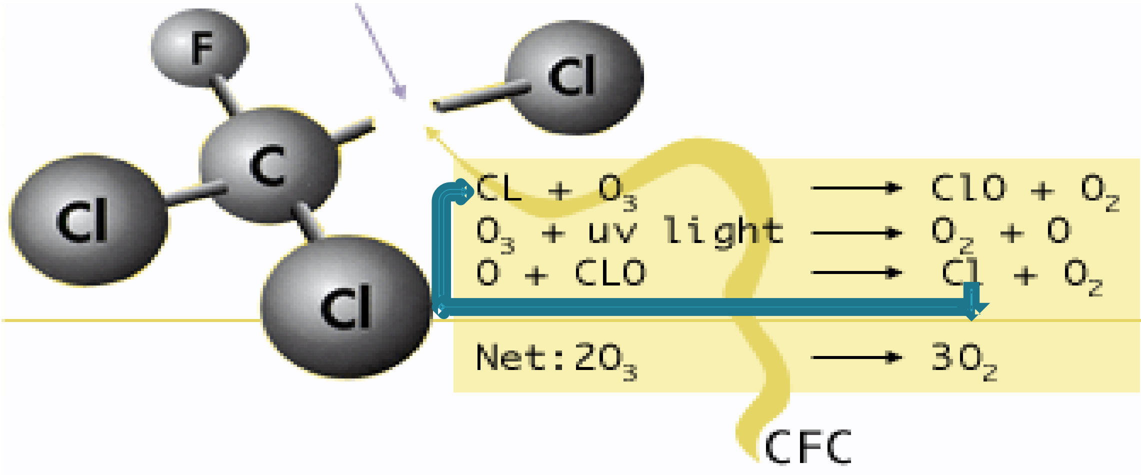
Stratospheric Ozone and Ultraviolet Radiation (UVR)

- **Ultra-violet radiation (UVR)** high energy electromagnetic wave emitted from the sun. It is made up of wavelengths ranging from 100nm to 400nm.

- **UV radiation includes** **UV-A**, the least dangerous form of UV radiation, with a wavelength range between 315nm to 400nm, **UV-B** with a wavelength range between 280nm to 315nm, and **UV-C** which is the most dangerous between 100nm to 280nm. UV-C is unable to reach Earth's surface due to stratospheric ozone's ability to absorb it. (Last, 2006)



Chemical Mechanism of Ozone Depletion



chlorine monoxide (ClO).

The chlorine atom is free to destroy up to 100,000 ozone molecules

- Different chemicals are responsible for the destruction of the ozone layer
- Topping the list :
  - chlorofluorocarbons (CFC's)
  - In the stratosphere, Ozone are photolysed, releasing reactive chlorine atoms that catalytically destroy ozone

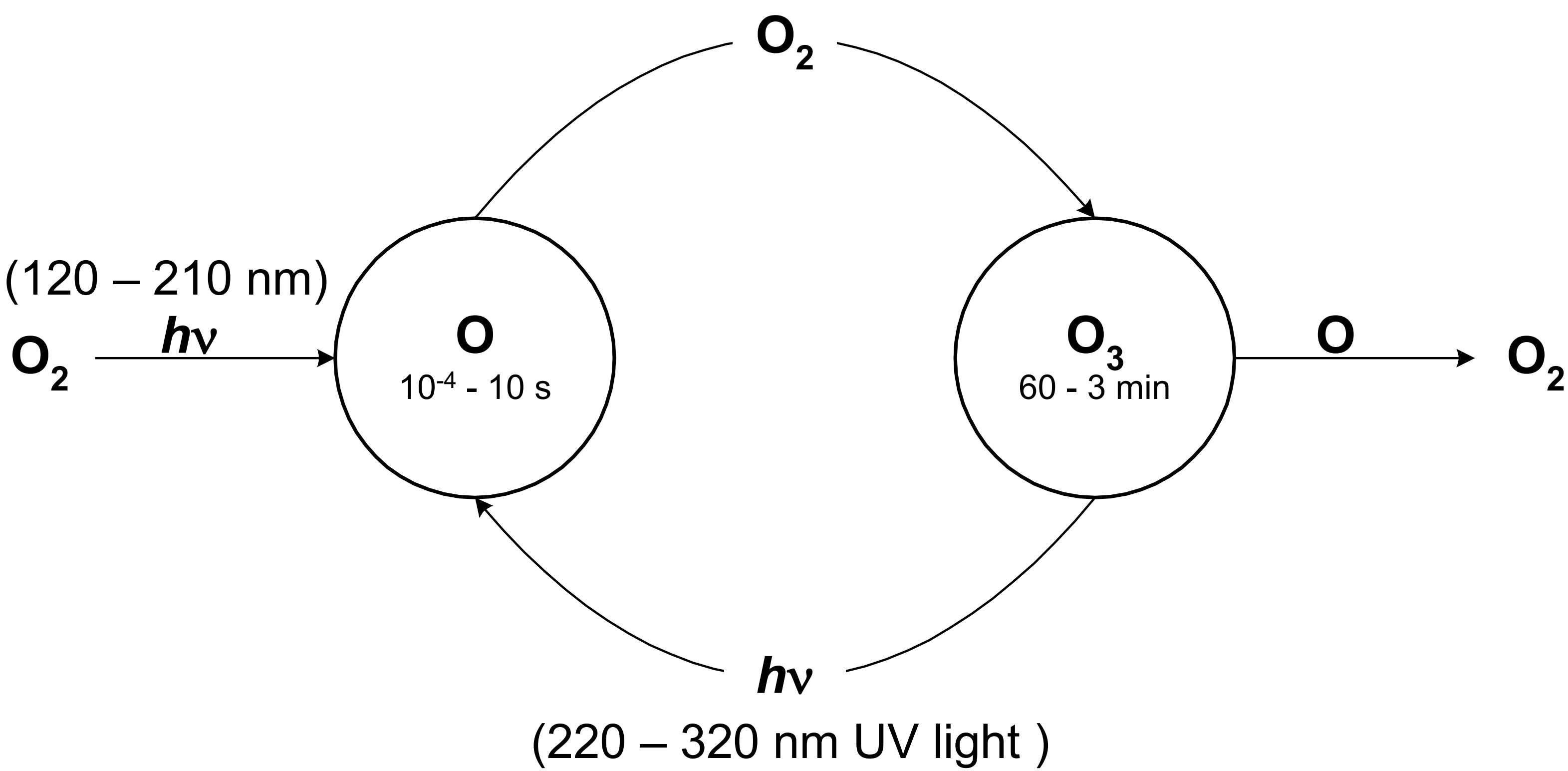
The Chapman Cycle

- 1930
  - Chapman (Australian scientist) proposed a series of reactions to account for the ozone layer known as *the Chapman Cycle*
  - The *Chapman Cycle* explains how the ozone layer is formed and maintained.
  - *Chapman Cycle :* Four chemical reactions
    - *Initiation* O_2 + light → 2O (120 – 210 nm)
    - *Propagation* (cycling)

      $O + O_2 + M \rightarrow O_3 + M^*$ (generates heat)

      O_3 + light → $O_2 + O$ (220 – 320 nm UV light)
    - *Termination* $O_3 + O \rightarrow 2O_2$

The Chapman Cycle



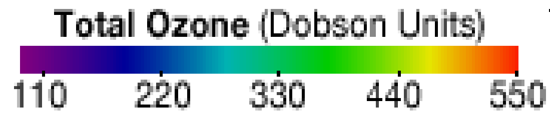
“odd-oxygen” species (O_x) are rapidly interconverted

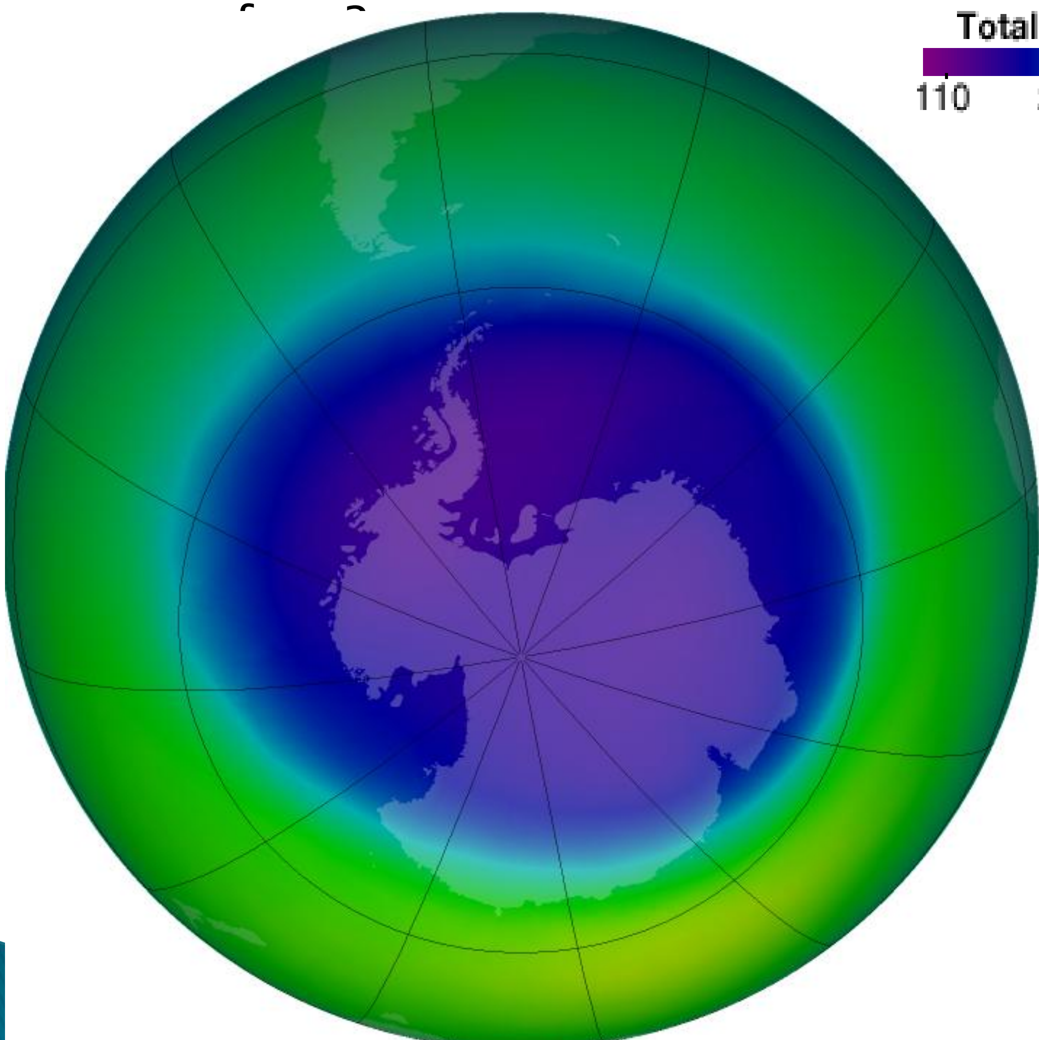
$$O_x = O + O_3$$

The "Ozone Hole"

Levels of ozone are measured in Dobson units (DU), where 100 DU is equivalent to a 1 millimeter thick layer of pure ozone

- What is the "ozone hole?" When did it first appear? How does it





The ozone hole is the region over Antarctica with total ozone 220 Dobson Units or lower. (The avg total column ozone in the atmosphere is about 300 DU.)

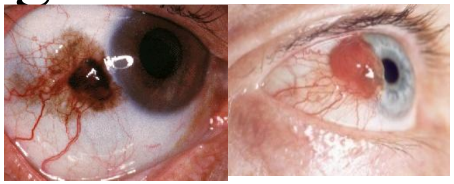
These conditions have led to ozone hole formation in Antarctica.

Ozone hole in Sept 2005. Source: NASA

Toxicity Effect

over exposure to UV-B

- Skin cancer
- Eye damage such as cataracts leading to blindness



- Immune system damage
- Reduction in phytoplankton
- Damage to the DNA in various life-forms form pyrimidine dimer lead to cancer

Over Exposure

- Suppress immune system
- Accelerate aging of skin due high exposure
- Cause an outbreak of rash in fair skinned people due to photo allergy – can be severe

dermis.multimedica.de/.../ en/13007/image.htm

What Is Being Done to Counter the Effects of Ozone Depletion?

- **Montreal Protocol (adopted in 1987)** – panel of experts was formed to investigate substances responsible for hole formation
  - Established policies that prevent future use of certain types of chemicals
  - Stipulated that the production and consumption of compounds contributing towards depletion of ozone in the stratosphere were to be phased out by the year 2000

Acid Rain

Acid Rain

Learning objectives

- What is acid rain?
- How is it formed?
- What effects does it have on people and the environment?
- How to reduce it?

Acid Rain

- **Acid Rain:** the deposition of different acidic mainly H_2SO_4, HNO_3 and H_2CO_3 along with rain water or particulate mater/dust/smoke of air called acid rain.

Types:

- **Wet deposition:** along with rain water
- **Dry deposition**: with particulate mater/dust/smoke etc of air
- Normally rain water pH is 5.6 due water reacting with carbon dioxide in the air to form carbonic acid

$CO_2\,(g) + H_2O(l) \rightarrow H_2CO_3(aq)$

$2SO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 2H_2SO_4\,(aq)$

The Formation of Acid Rain

$2NO_2(g) + H_2O(l) \rightarrow HNO_2(aq) + HNO_3(aq)$

The rest reacts with sunlight and ozone in the atmosphere; nitric (HNO_3), and sulphuric acid (H_2SO_4) are produced

Burn fossil fuels in

Transport, Industry, Homes, power stations

Some falls back to Earth close to the source as dry particles, gas and aerosols (NO_x and SO_2) (dry deposition)

NO_2 SO_2

Gas, Oil, Coal

It is dissolved in the moisture in the atmosphere making

$2H^+$ and SO_4^{2-}

and can be carried large distances before falling as rain or snow **(wet deposition)**

H^+ NO_3^- SO_4^{2-}

TRANSBOUNDARY POLLUTION

Causes Of Acid Rain

- **NATURAL CAUSES:-**
  - Volcanic emissions.
  - Biological processes.
  - Lightning.

Sulfur dioxide (SO_2) is emitted from the combustion of sulfur-containing fuels (coal and oil) and from the smelting of sulfur-containing ores (mostly copper, lead, and zinc). In the atmosphere, SO_2 is oxidized by OH to produce H_2SO_4:

$$HSO_3 + O_2 \rightarrow SO_3 + HO_2$$

$$SO_3 + H_2O + M \rightarrow H_2SO_4 + M$$

$$SO_2 + OH + M \rightarrow HSO_3 + M$$

- **ANTHROPOGENIC CAUSES:-**
  - Factories (industrialization)
  - Motor vehicles, automobile exhaust.
  - Coal based power plants.
  - Domestic fires.
  - Smelters.

- Which discharges huge amount of CO_2, SO_2, NOx to atmosphere.

Harmful impact of Acid Rain

Effect on plant and soil

Harmful to vegetation

- Increased acidity in soil
- Leeches nutrients from soil, slowing plant growth

  Mainly acid (H+) displace Ca^{+2}, Mg^{+2}, potassium etc.
- Leeches toxins from soil, poisoning plants
- Creates brown spots in leaves of trees, impeding photosynthesis
- Allows organisms to infect through broken leaves

Yellowish plant leave, chlorophyll damage(Chlorosis)

- **Microbes not able to tolerate low pH and die**
- **Upper fertile layer of soil is affect as essential nutrients are leached away from soil**

- Leeching of toxins from the soil by acid rain can be absorbed by plants and animals. When consumed, these toxins affect humans severely.
- Brain damage, kidney problems, and Alzheimer's disease has been linked to people eating "toxic" animals/plants.

e. Effect On Buildings

Metallic structure archeological structure

- Causes extensive damage to buildings, structural materials of marble ,limestone, slate etc.

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$$

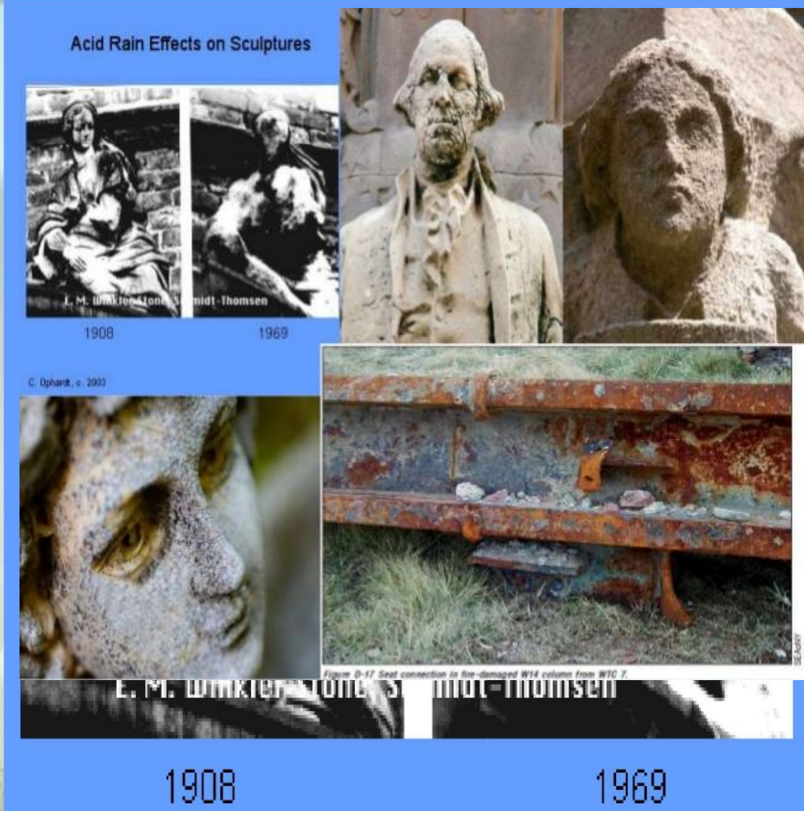
insolube

soluble

- In Greece and Italy invaluable stone statues have been partially dissolved by acid rain.

- Taj Mahal in Agra is also suffering due to acid fumes from Mathura refinery.

Acid rain dissolves the stonework and mortar of buildings that can be washed away by rain.



Cause corrosive damage/oxidation of metallic structure by acid rain

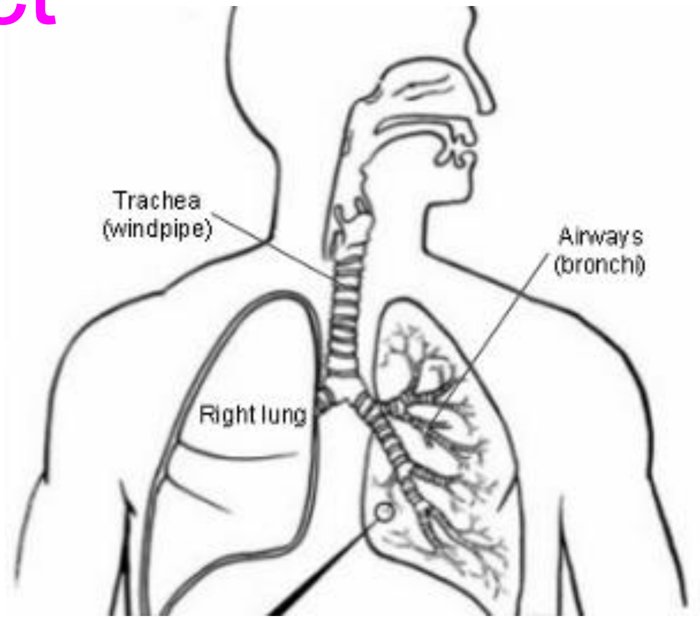
Effect of Acid rain to aquatic system

- Fish die off, and that removes the main source of food for birds. Also low pH ≤ egg will not hatch and fish and lose their ability to reproduce
- Chronic acidification reduce level of nutrient availability for fish

Also, birds can die from eating "toxic" fish and insects.

Human health effect

- Sulfur dioxide (SO2) and nitrogen oxides (NOx) gases turn in to particles that can be inhaled deep into people's lungs.
- In high levels of the fine particles there is an increase in illnesses, a key component of urban smog, cause inflammation and damage to tissues, and premature death from respiratory diseases such as:
- Asthma and Bronchitis.



Affects human health

- Respiratory problems, asthma, dry coughs, headaches and throat irritations
- Leeching of toxins from the soil by acid rain can be absorbed by plants and animals. When consumed, these toxins affect humans severely.
- Brain damage, kidney problems, and Alzheimer's disease has been linked to people eating "toxic" animals/plants.

Control measures

- **Clean combustion technologies**
- **Using pollution control equipments**
- **Replacement of coal by natural gas or renewable energy resources**

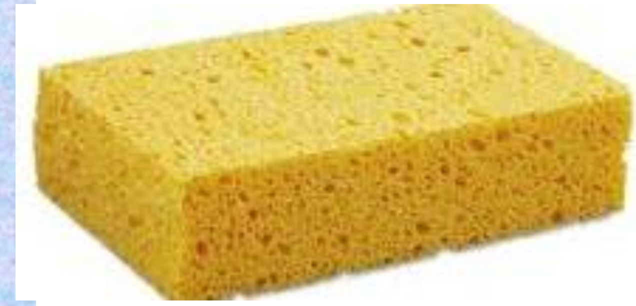
Wind power, solar panels, tidal power, hydropower and geothermal energy.

- **Liming of lakes and soils**
- **Formulate the policy framework for reduction of sulfur dioxide and other acid rain causing gas emissions.**
- **Support a set of subproject that promote cleaner production, reduce acid rain and air pollution, improve the environment.**

➢ Uses of catalytic converters to vehicle exhausts which remove the nitrogen oxides.

Control Measure

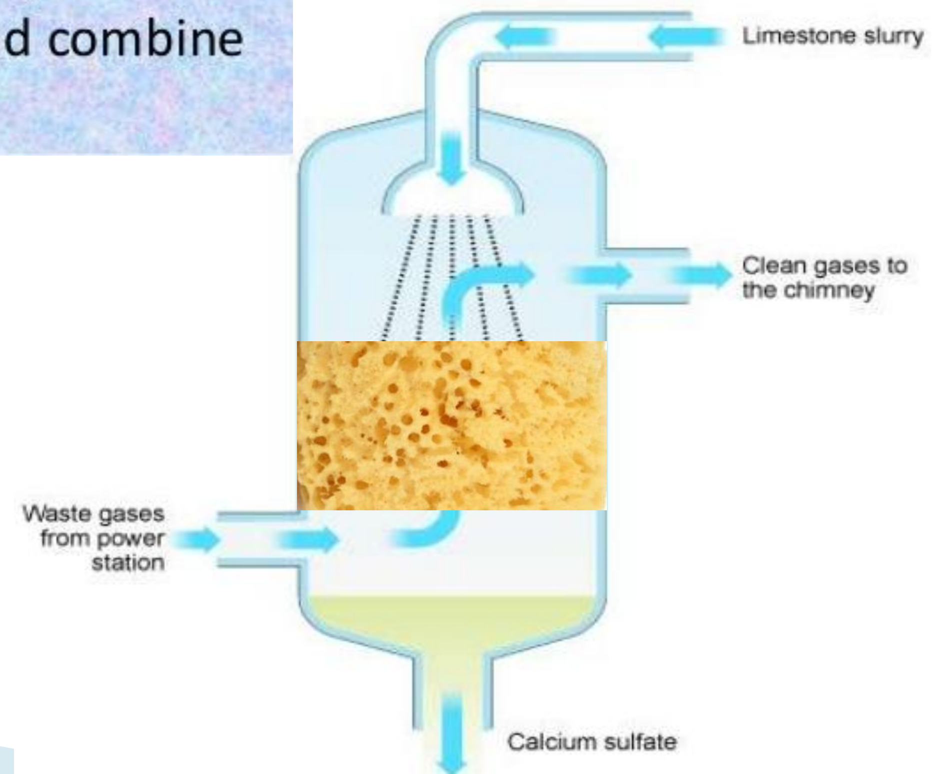
- Fluidized bed combustion also reduces the amount of sulfur emitted by power production.
- A wet scrubber is basically a reaction tower equipped with a fan that extracts hot smoke stack gases from a power plant into the tower.
- Lime or limestone in slurry form is also injected into the tower to mix with the stack gases and combine with the sulfur dioxide present.



- **Remove oxides of sulphur and oxides of nitrogen before releasing**
  - **Flue gas desulphurization**
  - **Catalytic Converters**

$$Ca(OH_2)+ SO_{2+}O_2= CaSO_4 + H_2O$$

Gas solid




Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU

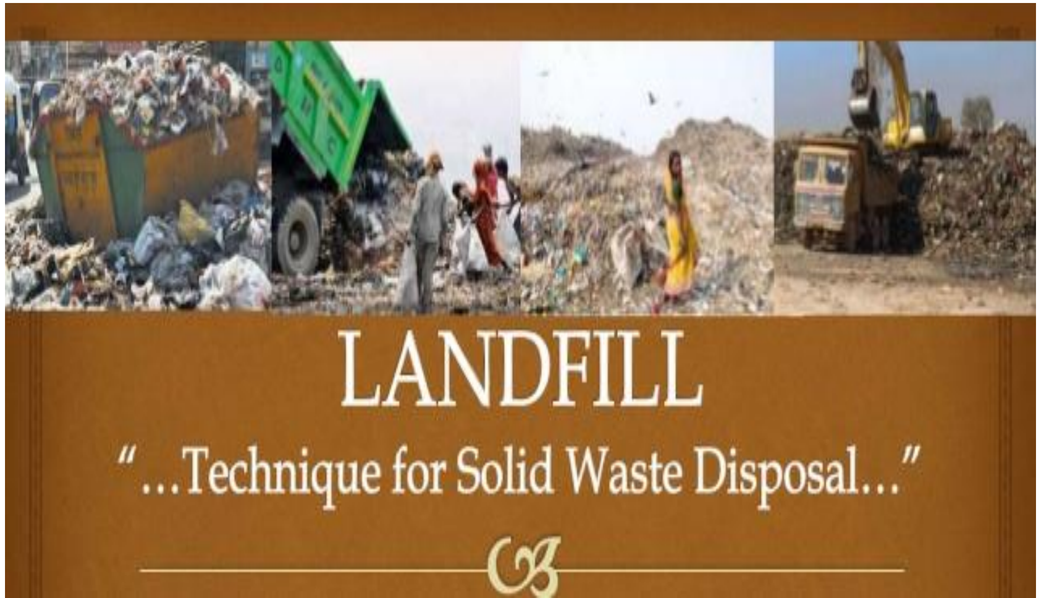

MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS

(Management Topic in Environmental Studies)

B. Tech 7TH Semester

Solid Waste management including Integrated Solid Waste Management (ISWM)

Department: Chemistry
Subject: MTES (CHM2049)



Contents

Solid waste

Definition

- All solid and semisolid wastes, arising from human and animal activities, and which are discarded as useless or unwanted, are called Solid Wastes or Refuse.
- This definition excludes human excreta and sullage (liquid waste from kitchen and bathroom).
- In normal life, solid wastes are seen in two common forms:

Rubbish: It include combustible (e.g., paper, card board, textile, plastic, rubber,
wood etc.) and non-combustible (glass, crokery, metals, construction wastes etc.)
solid wastes.

Garbage: It includes putrescible (that can rot) organic wastes, e.g., residue of fruits, vegetable and animals which are generally produced in cooking and eating of foods.

Types of Solid Waste

Biomedical waste

Plastic waste

Agricultural waste

Construction waste

Domestic/ Household waste

E- waste

Hazardous waste

Sources of solid waste

- Residential
- Commercial
- Institutional
- Construction and demolition
- Municipal services
- Treatment plant sites
- Industrial
- Agricultural
- Biomedical waste

Municipal solid waste (MSW)

Industrial solid waste

Agricultural waste

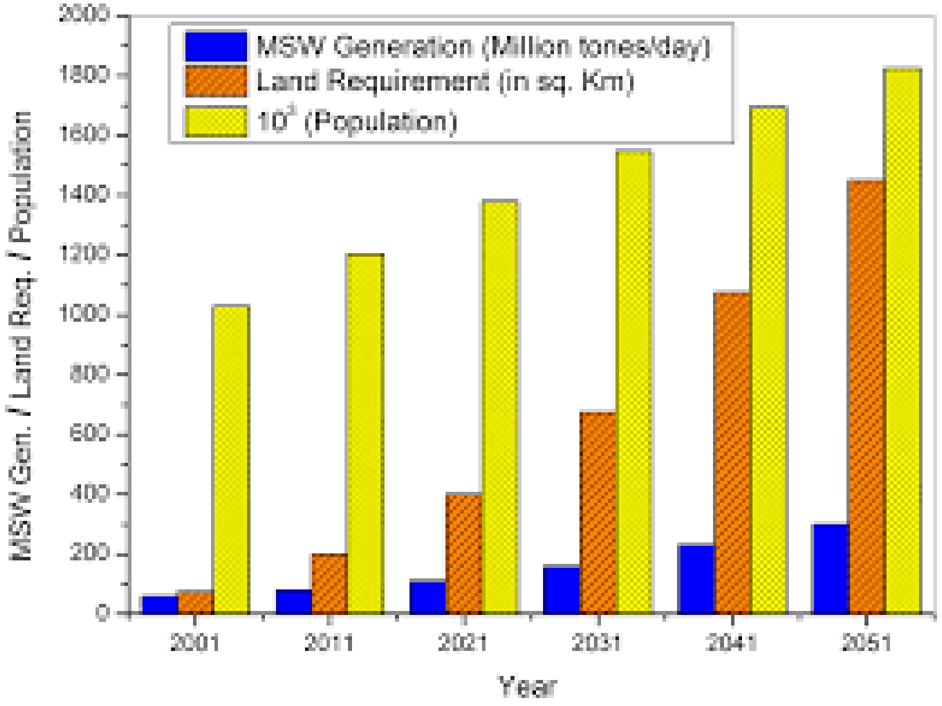
Hospital waste

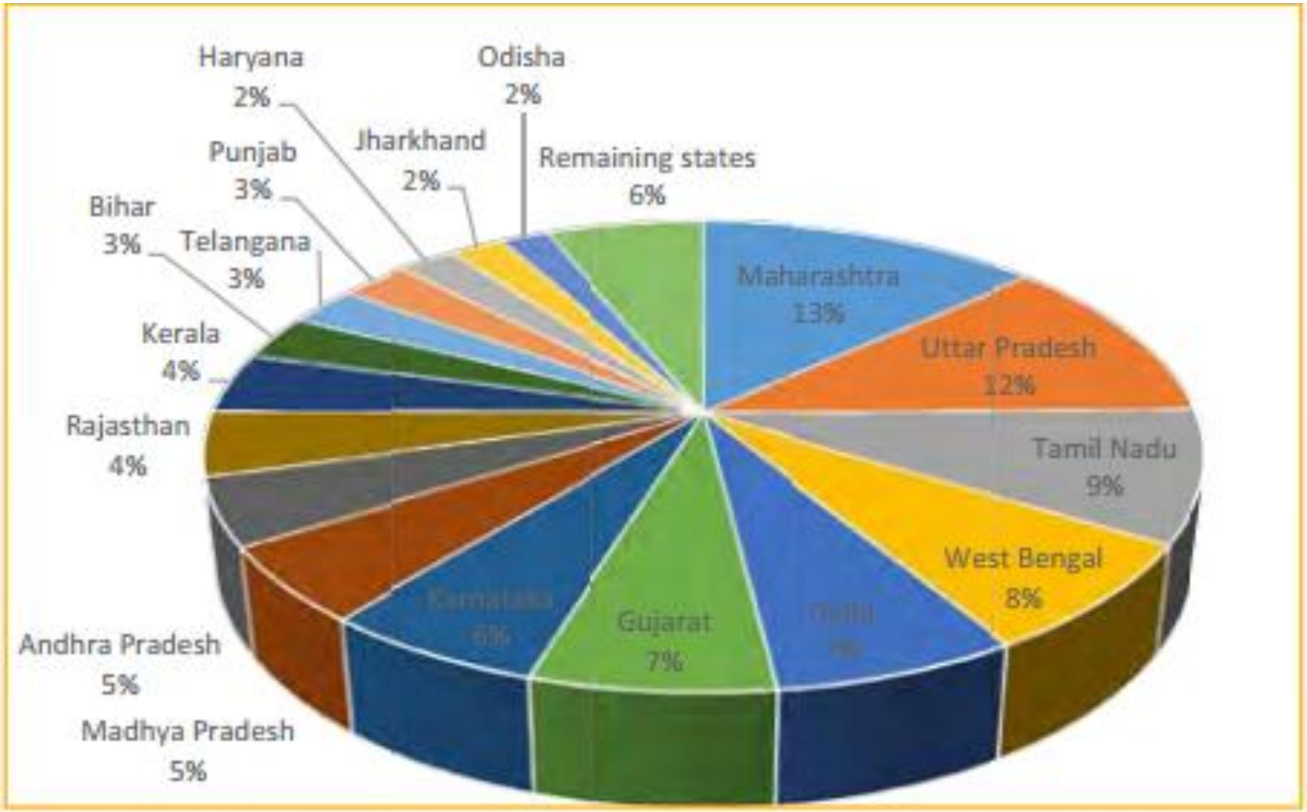
Types and Sources

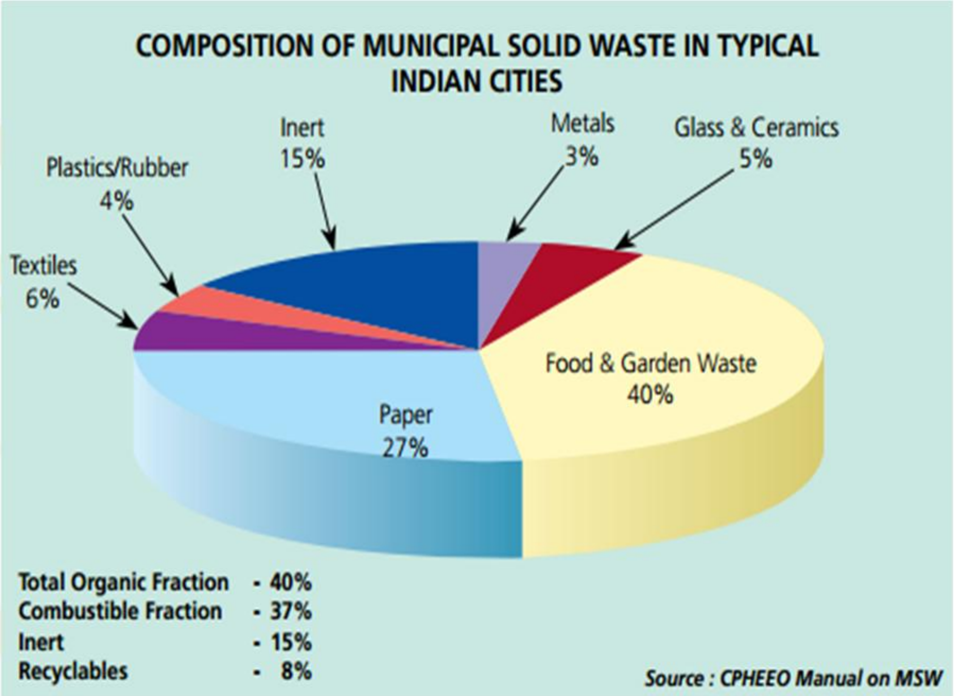
There are three categories of soil wastes:

- ❖ **Municipal Wastes:** These wastes arise from residential areas (household activities, streets), commercial areas (hotels, markets, institutions) and community areas (streets, parks, play ground).
- ❖ **Industrial Wastes:** These wastes arise from industrial activities and include rubbish, ashes, construction wastes, toxic wastes etc.
- ❖ **Hazardous wastes:** These are highly harmful wastes arising from hospitals, industries, nuclear plants, research institutions, laboratories and include biological wastes, toxic chemicals, radioactive substances, explosives and flammable wastes. **ignitability, corrosivity, reactivity & toxicity**

Solid waste generation in India







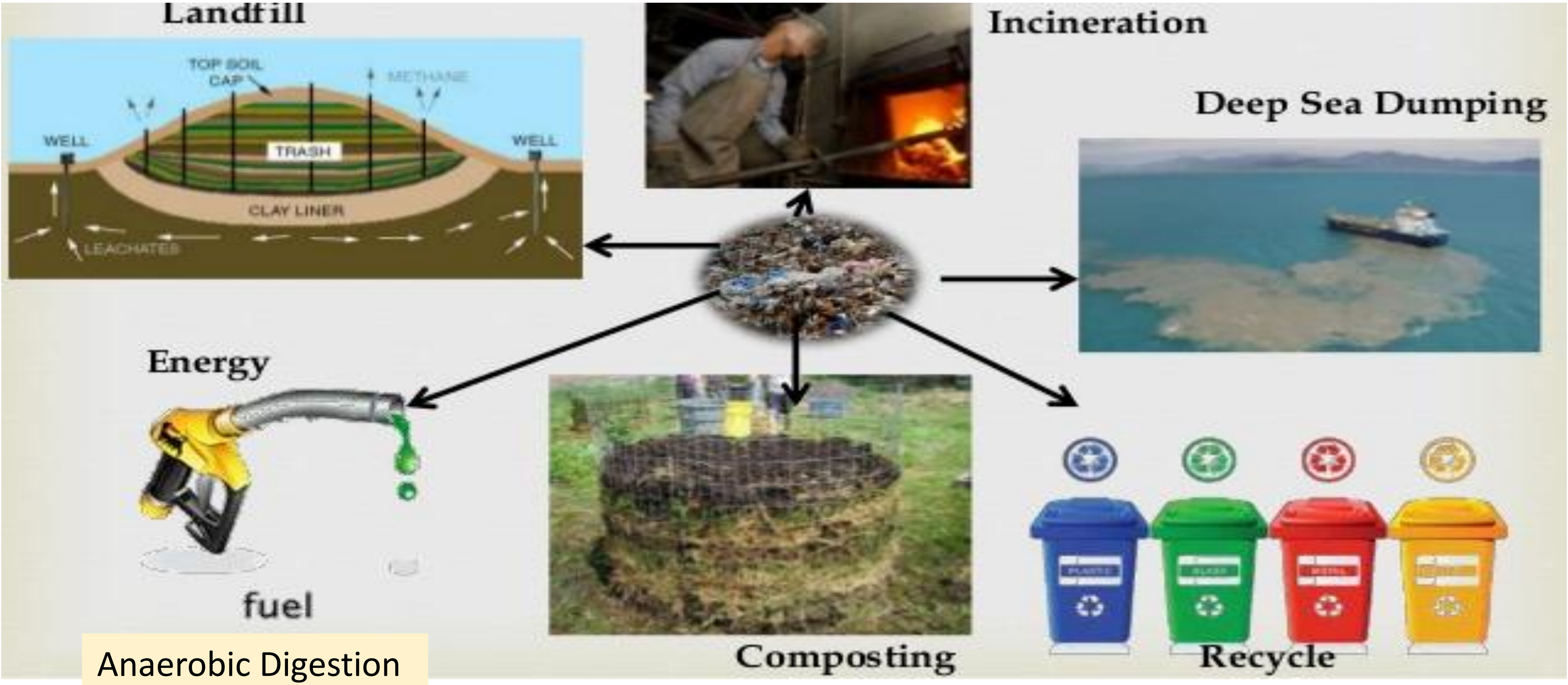
Cause of increasing solid waste generation

- **Overpopulation** and thereby increasing consumption and waste generation
- **Technological advancement** leading to cheap production of commodities
- **Rapid urbanization** and increasing availability of consumer products
- Growing trend of "non-returnable packaging" and "use and throw" culture
- Increasing purchasing power of public which lead to increasing consumerism, affluence and luxury

Effects of solid waste pollution

- Pathogens of different diseases arise from the wastes and spread diseases
- Solid waste may choke drains and pits which result in water logging and breeding of mosquitoes
- Stray animal (dogs, cattle) feed on the garbage, spread it and also fall ill
- Pollutants from garbage dump contaminate ground water and surface water
- Garbage dumps often destroy aesthetic value of the locality
- Fumes arising from burning of wastes pollute the air and foul smell due to decomposition of organic wastes create are unpleasant and create health problems

Technique for solid waste disposal



Anaerobic Digestion

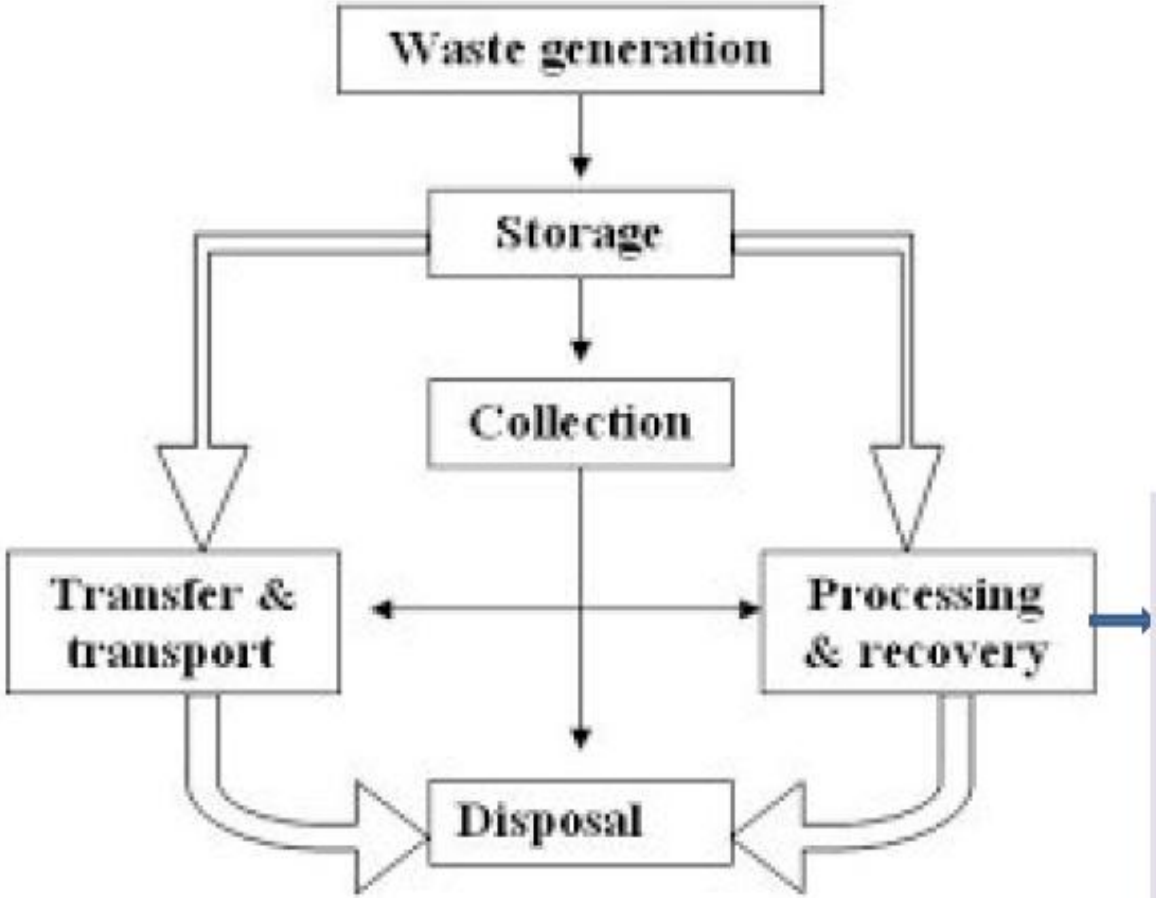
Solid waste management

With growing rate of solid waste generation all over the world, solid waste management has become one of the major necessities of the society, particularly in urban areas.

There are three parts of solid waste management:

A. Collection
B. Disposal
C. Recovery

Municipal Solid waste management



i) Recycle: plastic , paper Glass etc,

ii) Reuse: Wood for cooking Construction material for Road,

iii) Recover: (a)Heavy metal by Magnet

(b) Energy (CH_4) by anaerobic digestion

Solid waste management

A. Collection

- ✓ It involves collection of solid waste from the point of generation and its transportation to disposal site.
- ✓ Households usually collect their waste in dust bins and throws it in community storage place from where municipality or similar body pick it up and transport to disposal site.

Solid waste management

B. Disposal

Disposal means processing of waste so as to get rid of it. It also means to reduce volume, harmful effect and unpleasant appearance of solid waste. The collected solid waste is disposed in one of the following ways:

❖ **Open dumping**

- ✓ Waste is deposited in low laying land, usually on out skirt of town.
- ✓ No further processing is done. This is cheap and easier method, but it causes of air and water pollution and health hazards.
- ✓ Open dumping is commonly applied for disposing of community waste in many towns of India.

Types of Land fill

- **Sanitary Landfills** - landfill that uses a clay liner to isolate the trash from the environment
- **Municipal solid waste (MSW) landfills** - uses a synthetic (plastic) liner to isolate the trash from the environment
- **Construction and demolition waste landfills** - consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges.
- **Industrial Waste Landfills**- consists of nonhazardous waste associated with manufacturing and other industrial activities

  Fly ash, sold generated after metal extraction from ore
- **Secure Landfills** - landfills for the disposal of hazardous waste.

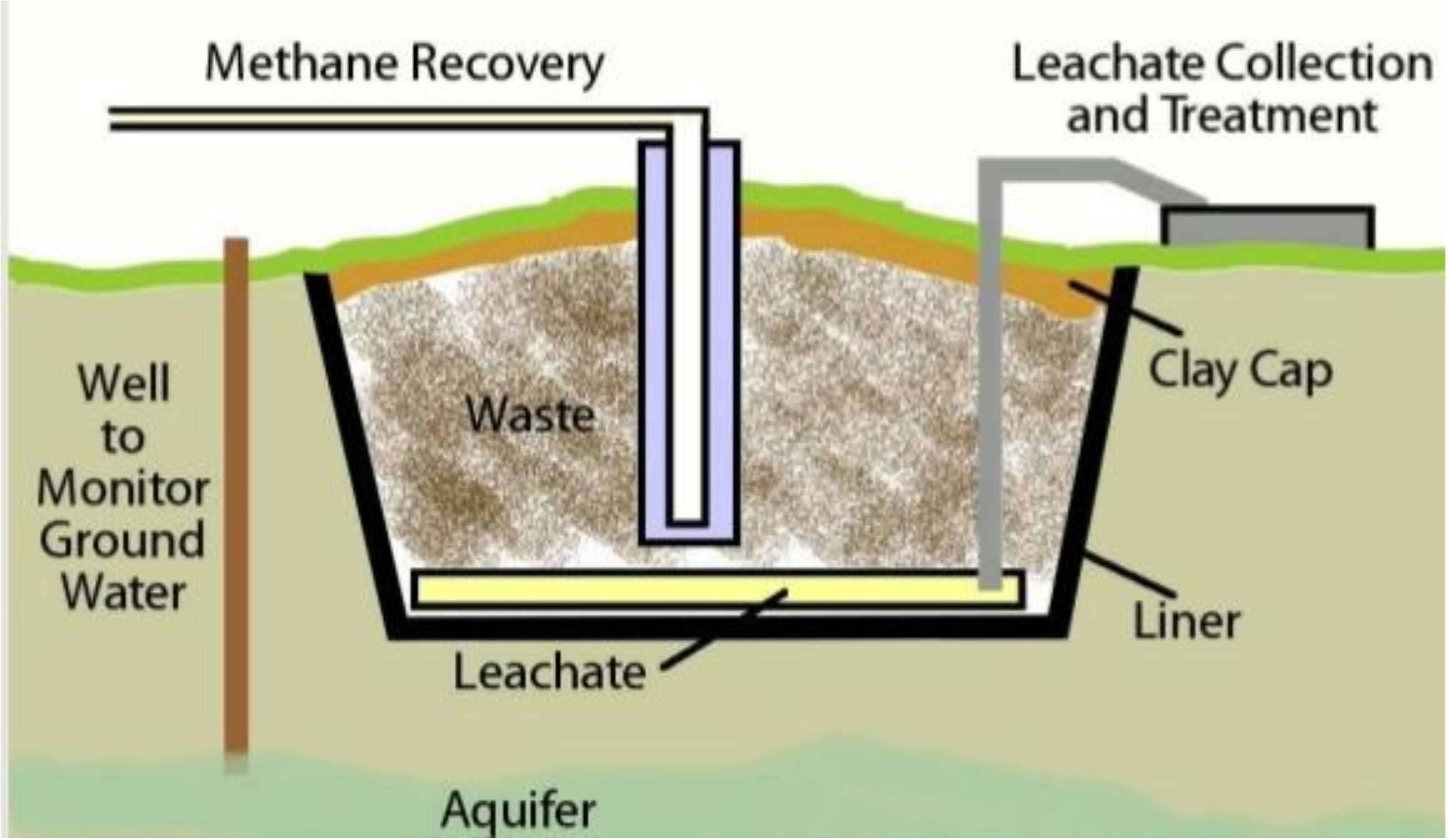
Solid waste management

❖ Sanitary land-filling

This is modified form of open dumping in which waste is deposited in layers of about 1.5 m thickness. These layers are covered with soil (20 cm) and compressed by bulldozers. Insecticides like DDT are sprayed on top layer to prevent mosquitoes and flies. The waste undergoes decomposition, stabilizes within a period of 2-12 months and settles down by 20-40% of its original volume.

- ✓ Sanitary land-filling is applied for disposing of municipal waste in metros and big cities of India.
- ✓ This method is simple, economical, does not require skilled labour and costly equipment, does not involve segregation or further processing, and can be done to reclaim low-lying areas.
- ✓ Negative aspects include large area requirement, soil requirement for covering, and use of insecticides and risk of ground water pollution.

Essential components of Land Fill



Solid waste management

❖ **Composting:** It involves biological decomposition of organic substances available in waste, under controlled conditions. It operates in both aerobic and anaerobic conditions. As a result of this volume and harmful effects of waste is reduces. The residue of the process is organic manure which contains minerals and can be applied in agriculture as fertilizer.

- ✓ There are three common methods of composting: (i) Trenching based composting (ii) Open window composting and (iii) Mechanical composting.
- ✓ Composting is practiced since long in India and it is the best suited to our environment. Composting is an ecofriendly method in which wastes are finally converted into simple compounds of nature. It produces valuable manure which protects soil fertility and reduces soil erosion. It can be practiced even a household level.
- ✓ Negative aspects or limitations include its slow processing, production of unpleasant smells, and its applicable only for bio-degradable wastes.

Solid waste management

- **Incineration:** Waste is burnt in controlled manner, at high temperature (700^0-1000^0C) in a large furnace known as incinerator. Prior to burning non-combustible items (e.g., metals, glass, crockery etc.) are segregated and removed. The combustion process produces CO_2, N_2 and water vapour. Waste reduces to ash which is only 10% of original volume.

- ✓ Incineration is commonly adopted for disposing of hazardous toxic waste in India. It is more common in developed countries.
- ✓ This method is quick, require little space, involve less transportation cost, highly reduce volume of waste and provide safest disposal.
- ✓ Negative aspects include high capital (initial) and operating cost, need of skilled manpower and air pollution. Besides it, segregation of waste and final disposal of ash is also required. It may generates some more toxic gas

Solid waste management

❖ Pyrolysis or destructive distillation

In this method waste is heated at high temperature (700^0-1000^0C), but in anaerobic conditions (low or no O_2). Unlike incineration, Pyrolysis is exothermic process which is meant to recover chemical energy of organic wastes. The process converts organic wastes into CO, CO_2, CH_4, tar etc.

✓ It is less frequently applied method in India. Its merits and demerits resembles to that of incineration.

❖ Pulverization

In this method waste in converted into powder by mechanical grinding. This reduces volume of the waste and changes its physical character. This is further disposed of by land-filling.

✓ Due to high capital and running cost, it is not common in India.

Solid waste management

❖ Disposal into sea

This method is adopted in coastal areas which have deep sea water (>30 m) at a moderate distance (<16-20 km) with strong forward current. (Nuclear waste)

- ✓ This is cheap method that can be adopted in coastal areas.
- ✓ Negative aspects include limited applicability for coastal areas, spoiling of sea beaches due to return of wastes to coasts, and difficulties during monsoon and storms.

Numerical Solid waste Management

- Compute the landfill area requirement for 20 years of a city with population of 10 lakh. (*Given: MSW generation = 500 gm per capita per day; MSW density = 500 kg/m3).*
- Solution: total time = 20 year= 20x365 day

Total population = 10 lakh

MSW generation = 500 gm per capita per day;= 0.5 kg

Thus total mass of MSW generation in year by 10 lakh peoples = 0.5kg/daypx10,00000px20x365day=3650000000kg = 36.5x10^8kg

Given MSW Density = Mass/volume = 500kg/m^3 (1)

Putting earlier calculated mass in equation 1

36.5 x10^8 kg/volume= 500kg/m^3

Volume of landfill required = 36.5 x10^8 kg/500kgm^{-3} = 73,00000 m^3

Assume height of land fill is 10 m

Thus area of land fill = total volume of land fill/ height= 73,00000 m^3/ 10m = 73,0000 m^2

Since in a land fill total land requirement = land required to dump solid waste+ same amount of land required to construct road for vehicle movement

Thus total land requirement = 73,0000x2 = 1,460,000 m^2


Measure consumption of environmental resources
Reduce emissions
Calculate emissions
Environment Sustainability
Reduce consumption
Report consumption and emissions externally
Identify reduction

THANK YOU


MASS EXTINCTION
BUSH FIRES
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NEXT 100 YEARS

(Management Topic in Environmental Studies)

B. Tech 7TH Semester

Noise pollution

Department: Chemistry
Subject: MTES (CHM 2049)

Contents

Noise Pollution

Introduction

- It is an unpleasant and disturbing sound, responsible for several auditory and no-auditory adverse effects on human health and well-being, ranging from simple annoyance to hearing loss.
- According to WHO, Noise is considered as a major concerned environmental factor for an unhealthy society (WHO, 2011)
- Noise is a perpetual, significant contributor to occupational diseases in numerous working environments.
- Noise health effects depend on the combination of intensity, frequency and duration of exposure to noise

Sources of Noise Pollution

Industries

Rail and Air traffic

Road traffic

Construction

Indoor sources

Loud speakers

Fire crackers

Properties of Sound

- Physically: Sound is a mechanical disturbance propagated as a wave motion in air and other elastic and mechanical media such as water or, steel.
- Physiologically: Sound is an auditory sensation evoked by this physical phenomenon.(not all sound wave evoke an auditory sensation, e.g., the frequency of ultrasound is too high to excite the sensation of hearing)
- Sound waves involve a succession of compressions and rarefactions of an elastic medium such as air.
- The sound waves are characterized by: the amplitude of pressure changes, their frequency and the velocity of propagation.

Wavelength=speed of Sound/ frequency.

Speed of sound in air(20°C)=344 m/s.
Sound travels much faster in solids than in air.
(wood=3,962 m/s, Steel=5,029 m/s)

frequency

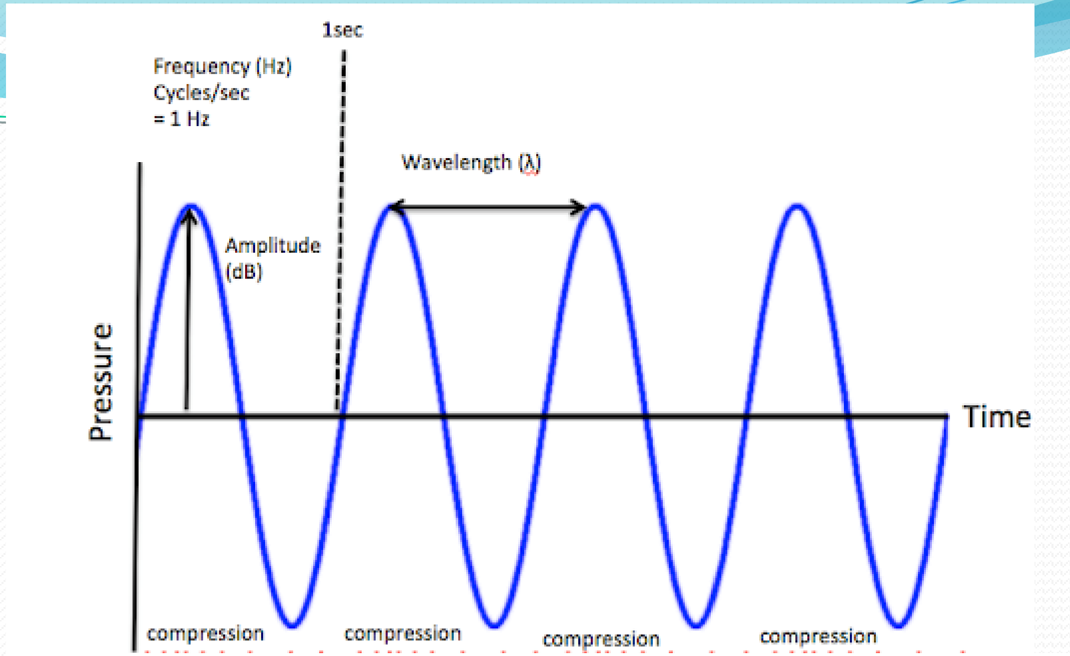
Number of compressions and rarefactions per unit time (sec)

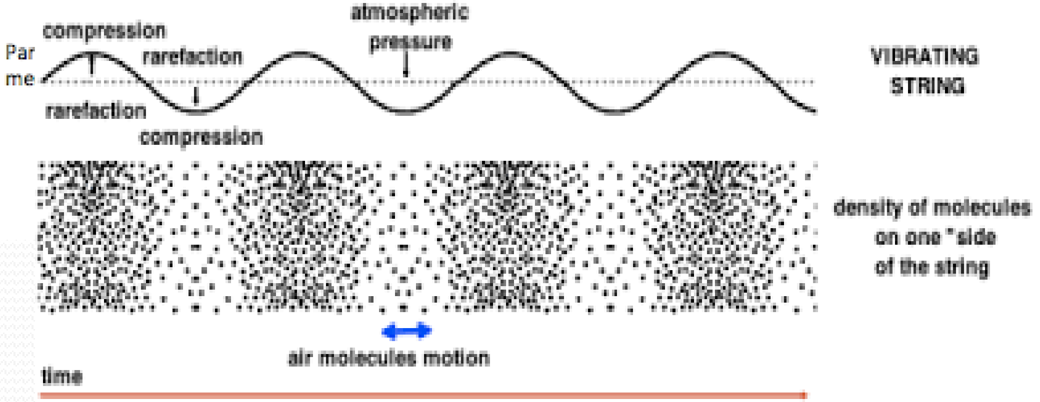
unit=hertz(Hz)

Sound Power

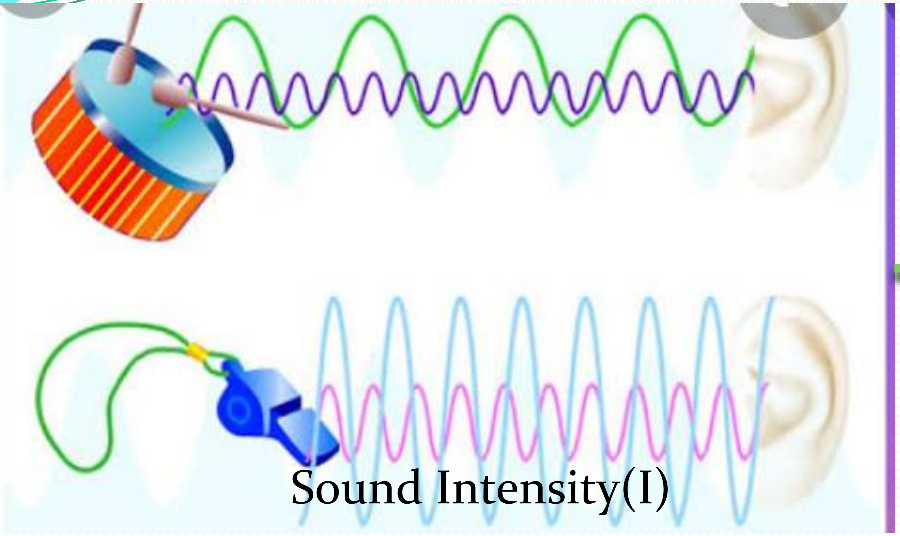
Rate at which energy is transmitted by a sound wave

Represented in terms of watt.
Watt=Joules/Sec

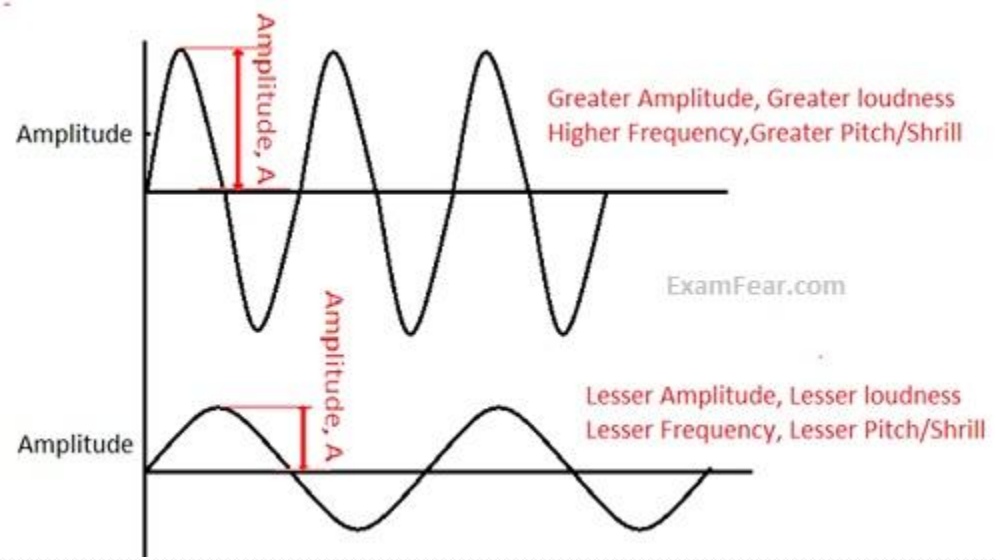




Frequency range
(20-20,000 Hz)



Sound Intensity(I)



Average sound power per unit area in the direction of propagation of sound wave.

I=W/A (watt/m^2)

For a vibrating sphere,

$I= W/4\pi r^2$

When Noise is far away from the source, Sound intensity (I)

$I=P^2/\ell e$

P=Sound Pressure

ℓ=Density of the medium i.e., air=1.185

e=speed of Sound i.e.,340m/sec.

Decibel

- A scale ten times the logarithm of the ratio of a measured quantity to specified reference quantity.
- It represents sound level.

Sound power level, $L_w = 10\log_{10}(W/W_o)$

W=measured Sound power

W_o=Reference sound power(10^{-12}W)

Sound pressure level (Lp)

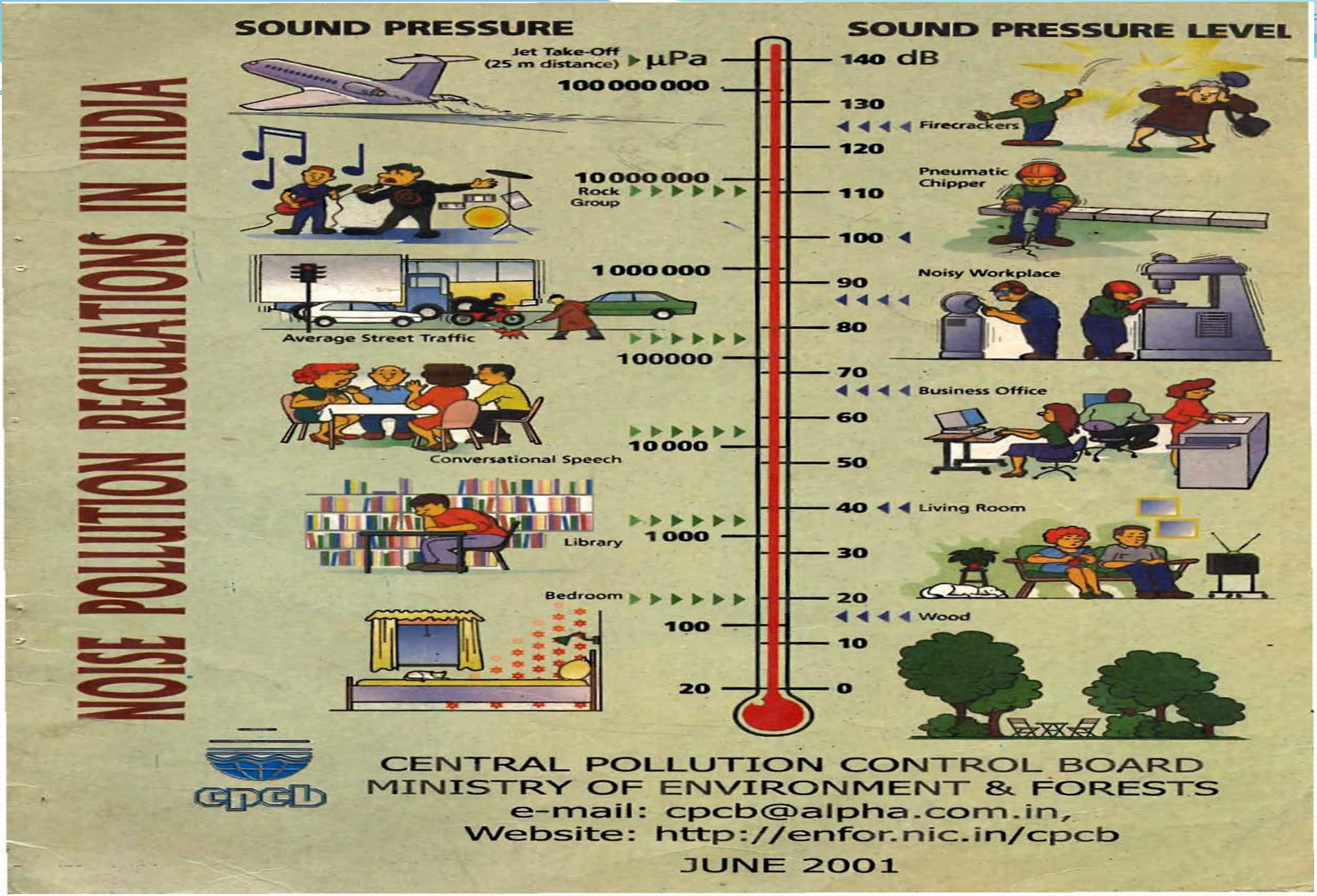
Sound is measured with a Sound level meter which is usually a portable self contained instrument incorporating a microphone amplifier, a voltmeter and a attenuator. The whole of which is calibrated to read sound pressure level directly.

Sound pressure level,
$Lp(dB)=10\log_{10}(P/P_r)^2$.....(i)
P=measured Sound Pressure
P_r=Reference sound Pressure(20μp)

Average sound pressure levels

$$\overline{Lp} = 20\log \frac{1}{N}\sum_{j=1}^{N} 10^{\left(\frac{Lj}{20}\right)} \text{............(ii)}$$

Lp=Average Sound pressure level.
Lj=The jth sound pressure level.
j=1,2,3.........N


NOISE POLLUTION REGULATIONS IN INDIA
SOUND PRESSURE
SOUND PRESSURE LEVEL
Jet Take-Off (25 m distance)
µPa
140 dB
100 000 000
130
Firecrackers
120
Pneumatic Chipper
10 000 000
Rock Group
110
100
1 000 000
90
Noisy Workplace
80
Average Street Traffic
100000
70
Business Office
60
10 000
Conversational Speech
50
40
Living Room
Library
1 000
30
Bedroom
20
Wood
100
10
20
0
cpcb
CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT & FORESTS
e-mail: cpcb@alpha.com.in,
Website: http://enfor.nic.in/cpcb
JUNE 2001

Problems

1. The sound power generated from a moving tractor is 0.001 watt. What is the Sound Power Level?

Ans-

As we know, $Lw=10\log_{10}(w/w_o)$

$=10\log(0.001/10^{-12})$

$=90$ dB

2. If a sound source has a pressure of 2000μp at 10m distance. Configure the sound pressure level in dB?
   - Sound Intensity in watt/m².
   - Sound Power in watt. (w?/Lw)

Ans-

As we know, $Lp(dB)=10\log_{10}(P/P_r)^2$

$=10\log(2000/20)^2$

$=40$dB

ii. As we know, $I=P^2/\ell e$

$=(2000\times10^{-6})^2/(1.185\times340 m/s)$

$=9.9\times10^{-9}$ watt/m².

iii. Given, r=10m

Here measured sound power is not given.

So, I= $W/4\pi r^2$

$I = w/4\pi r^2$

$\Rightarrow 9.9x10^{-9}=W/4x3.14x100$

$\Rightarrow W= 1.24x10^{-5}$watt

So, $Lw=10\log_{10}(w/w_o)$

$=>Lw=10\log((1.24x10^{-5})/10^{-12})$

$=>Lw=71$ DB

3. Determine the sound power level by combining 5 sound levels i.e., 61 dB, 54 dB, 73 dB, 67 dB and 45dB?

Ans. $Lw_a=10\log_{10}(Wa/W_o)$

$=>Wa = Wo \times 10^{Lwa/10}$

$=>Wa=Wox10^{61/10}$

Here, Lw_a=61dB, Lw_b=54dB, Lw_c=73dB, Lw_d=67dB and Lw_d=45dB

So, $Wb=Wox10^{54/10}$ $Wc=Wox10^{73/10}$ $Wd=Wox10^{67/10}$ $We=Wox10^{\frac{45}{10}}$

W=Wa+Wb+Wc+Wd+We

$=Wo(10^{6.1}+10^{5.4}+10^{7.3}+10^{6.7}+10^{4.5})$

Resultant Sound Power $Lw = 10[logWo(10^{6.1}+10^{5.4}+10^{7.3}+10^{6.7}+10^{4.5})/Wo]$

$=>Lw=74.23$dB

Equivalent Continues Noise Level

'Equivalent continues noise level(L_{Aeq})' of that steady sound which over the same interval of time contains the same total energy as the fluctuating sound.

$$LAeq=10\log_{10}\left(\frac{1}{T}\sum_{i=1}^{n}10^{0.1li}\times t_i\right)$$

Where, T=total time of Operation.
Li=Noise Level of the ith Sample.
ti=fraction of total time.
n=number of sample.

Problem

1.If an Industrial fan generates a noise level of 65 dB(A) for 10 minutes out of every hour. Compute the LAeq, if the background level is 55dB(A)?

Ans–$LAeq$=10 $\log_{10}(\frac{1}{T}\sum_{i=1}^{n} 10^{0.1li} \times t_i)$

Here, T=60,L1=65 dB(A) and L2=55dB(A) t1=10, t2=50

So, $LAeq$=10log $[\frac{1}{60}(10^{0.1\times65} \times 10) + (10^{0.1\times55} \times 50)$

= 59dB(A)

Ambient Air quality standards in respect of Noise

Area Code	Category of Area/Zone	Limits in dB(A) L_{eq}*	
		Day time	Night time
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45
D	Silence Zone	50	40

Note :-

1. *Day time shall mean from 6.00 a.m. to 10.00 p.m.*
2. *Night time shall mean from 10.00 p.m. to 6.00 a.m.*
3. *Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority.*
4. *Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.*

Permissible Noise level standards for house appliances

60dB(A
)

68
dB(A)

75
dB(A)

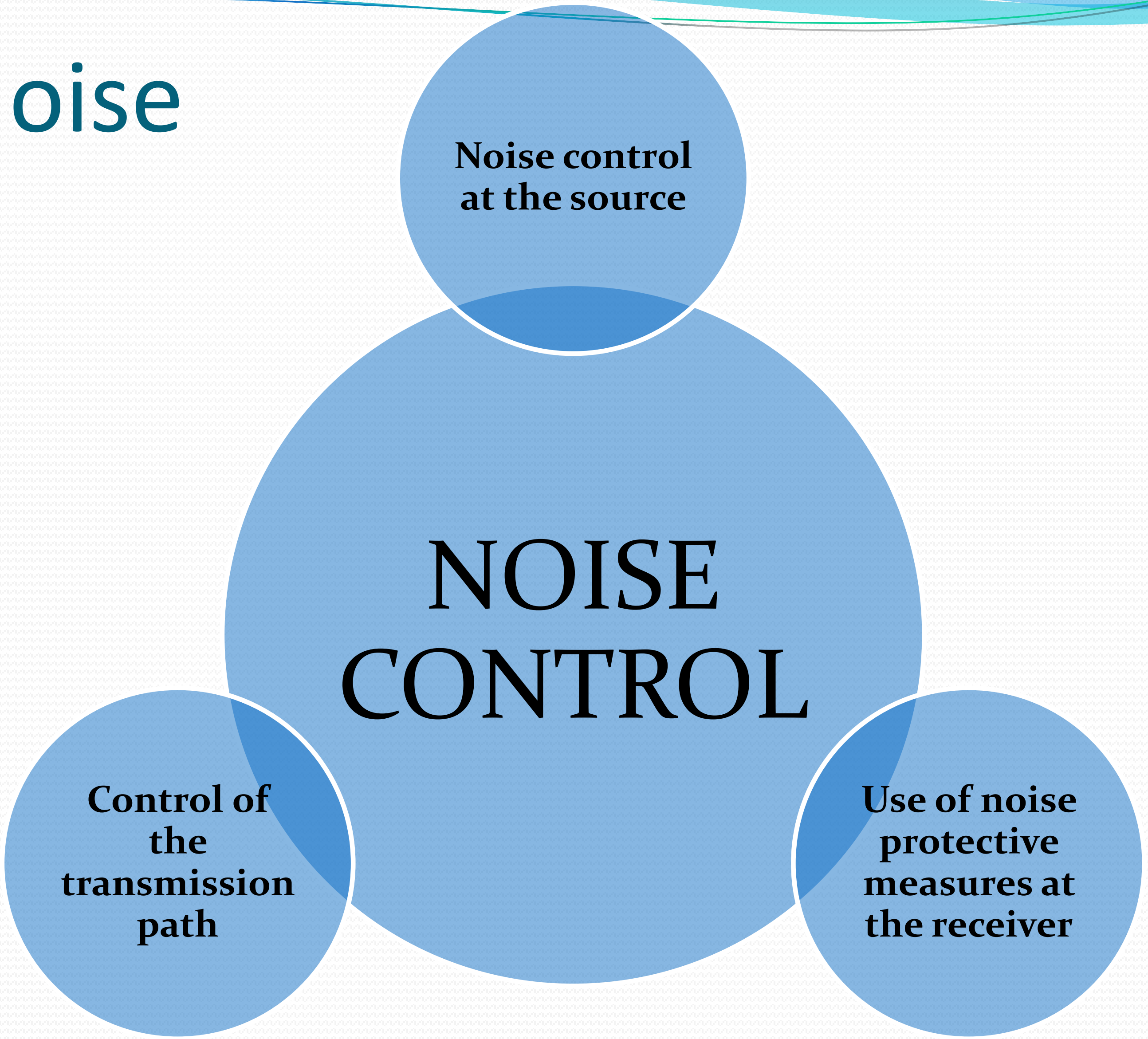
85-90
dB(A)

Impact of Noise pollution on health

Pathological Effects	Physiological Effects	Psychological Effects
Hearing loss, reduction of speech intelligibility, acoustic traumas, auditory fatigue, etc.	Changes in blood pressure, pulse rate, constriction of blood vessels, dilation of the pupil of eye and changes in blood cholesterol content, etc.	Feelings of discomfort, sleep interference, reduced intellectual performance, fatigue, vexation, irritation, distress, mental or neurological disorders, antisocial behaviour, etc.

Noise above 60dB has a negative effect on increased use of psychotropic medication.

Control of Noise



Noise Reduction at the Source

- The reduction of the exciting forces e.g., reduction of impacts or, impulsive forces, balancing of moving masses, reduction of frictional forces by proper alignment and lubrication etc.
- Application of vibration dumping materials to the radiating surfaces. Rubber plastic between to metallic body
- Changes in operating procedure, e.g., a factory, adjacent to the residential areas, suspend or reduce noise generating operations at night
- Sound generating instrument running in sound insulating room

Noise control of the transmission path

- Sitting e.g., increasing distance between source and the Receiver.
- Path deflection e.g., by use of barrier. Sound deflector tile ,
- Properly designed enclosures.
- Absorption e.g., use of sound absorbing material in a room where both the source and the receiver are present in a room.

Protective Measures at the receiver

- Use of personal protective equipment, e.g., use of earplugs, earmuffs, noise helmets etc.
- Education and public relations.
- Exposure Control. e.g., the rotation of personnel so that work assignments in the intense noise area are for a limited period of time only.


thank you

Management Topic in Environmental Studies)

B. Tech 7TH Semester

Forest Resources

Unit 2

Natural Resources

Department: Chemistry

Subject: MTES (CHM2049)

Contents

- Introduction to Forest Resources
- Benefit of Forest Resources
- Over exploitation of forests
- Deforestation and causes of Deforestation
- Effects of Deforestation

Forrest Resources

- Forests are one of the most important natural resources on this earth
- 1/3rd of the worlds land area is forested
- Former USSR accounts for about 5th of the worlds forests,
- Brazil for about a 7th and Canada and USA each for 6-7%.
- Natural forests has declined over the years.

The greatest loss in tropical Asia where 1/3 of the forest resources have been destroyed

Direct benefits from forests

(a)Fuel Wood: Wood is used as a source of energy for cooking purpose and for keeping warm.

(b) Timber: Wood is used for making furniture, tool-handles, rail sleepers, matches, ploughs, bridges, boats etc.

(c) Bamboos: These are used for matting, flooring, baskets, ropes, rafts, cots etc.

(d) Food: Fruits, leaves, roots and tubers of plants and meat of forest animals form the food of forest tribes.

(e) Shelter: Mosses, ferns, insects, birds, reptiles, mammals and microorganisms are provided shelter by forests.

Wild life habitat: Forests are the homes of millions of wild animals and plants.

About 7 million species are found in the tropical forests alone.

Direct benefits from forests

(f) Paper: Wood and Bamboo pulp are used for manufacturing paper (Newsprint, stationery, packing paper, sanitary paper)

(g) Rayon: Bamboo and wood are used in the manufacture of rayon (yarns, artificial silk-fibres)

(h) Forest Products: Tannins, gums, drugs, spices, insecticides, waxes, honey, horns, musk, ivory, etc. are all provided by the flora and fauna of forests.

The indirect benefits from forests

(a) **Conservation of Soil:** Forests prevent soil erosion by binding the soil with the network of roots of the different plants and reduce the velocity of wind and rain which are the chief agents causing erosion.

(b) Soil-improvement: The fertility of the soil increases due to the humus which is formed by the decay of forest litter.

Indirect benefits from forests

- (c) **Reduction of Atmospheric Pollution:** By using up carbon dioxide prevent global worming and giving off oxygen during the process of photosynthesis, forests

  reduce pollution and purify the environment.
- **(d) Control of Climate:** Transpiration of plants increases the atmospheric humidity which affects rainfall and cools the atmosphere.
- **(e) Control of Water flow and Regulation of Hydrological Cycle:** In the forests, the thick layer of humus acts like a big sponge and soaks rain water preventing run-off, thereby preventing flash-floods. Humus prevents quick evaporation of water, thereby ensuring a perennial supply of water to streams, springs and wells.
- About 50-80 % of the moisture in the air above tropical forests comes from their transpiration which helps in bringing rain

Over exploitation of forests

- Humans depended heavily on forests for food, medicine, shelter, wood and Excessive use of fuel wood and charcoal,
- Raw material like timber, pulp, minerals, fuel wood etc.
- large scale logging, mining, road-building, Industry, Dam and hydropower
- National economy. The international timber trade alone is worth over US $ 40 billion per year.
- Rapid Urbanization, agricultural and industrial areas and overgrazing

Deforestation

- The total forest area of the world in 1900 was 7,000 million hectares

  in 1975 reduced to 2890 million ha

  by 2000 drop down to 2,300 million ha
- Deforestation rate is relatively less in temperate countries, but alarming in tropical countries 40-50 percent
- The rate at which deforestation is occurring is a matter of great concern. Currently, 12 million hectares of forests are cleared annually.
- At this rate all moist tropical forest could be lost by the year 2050, except for isolated areas in -Amazonia, the Zaire basin (Congo), as well as a few protected areas within reserves and parks.
- Some countries such as Ivory Coast, Nigeria, Costa Rica, and Sri Lanka are likely to lose all their tropical forests if no conservation steps are taken.

Deforestation

- The forested area in India seems to have stabilized since 1982 with about 0.04% decline annually between 1982-90.
- FAO (1983) estimated that about 1.44 m ha of land was brought under afforestation
- The target forest area 33% But at present 19.27 % of our land area ,(63.38m ha) covered by forests based on satellite data (MoEF, 1998)

Causes of Deforestation

(1) Population Explosion:

- i) Vast areas of forest land are cleared of trees to reclaim land for human settlements (factories, housing, roads, railway tracks etc.).
- ii) **Development projects**: Massive destruction of forests by development projects like hydroelectric projects, big dams, road construction, mining etc
- iii) **Raw materials for industrial use**: Wood for making boxes, furniture, railway-sleepers, plywood, match-boxes, pulp for paper industry. Plywood for packing tea for Tea industry fir tree for Apple
- iv) **Fuel requirements**: like timber, firewood, paper and other valuable products of industrial importance, all necessitating felling of trees.
- v) **Shifting cultivation**: slash and burn for agriculture clear more than 5 lakh ha of forests annually. This practice in North- East and to some extent in Andhra Pradesh, Bihar and M.P
- vi) **Growing food needs:** To meet the demands of rapidly growing population, agricultural lands and settlements are created permanently by clearing forests.

Forest Fires

2. Fires in the forests may be due to natural calamities or human activities:

- (a) **Smoldering** (burning slowly without flame) of the humus and organic matter forming a thick cover over the forest floor (i.e. ground fires).
- (b) Dried twigs and leaves may catch fire (i.e. surface fires).
- (c) In densely populated forests, tree tops may catch fire by heat produced by constant rubbing against each other (i.e. crown fires).
- (d) Human activities like clearing forest for habitation, agriculture, firewood, construction of roads, railway tracks and carelessness (throwing burning cigarette stubs on dried foliage).
- Fire destroys fully grown trees, results in killing and scorching of the seeds, humus, ground flora and animal life.

- **(3) Grazing Animals:**

  Trampling of the forest soil in the course of overgrazing by livestock has effects such as loss of porosity of soil, soil erosion and desertification of the previously fertile forest area.
- **(4) Pest Attack:**

  Forest pests like insects etc. destroy trees by eating up the leaves, boring into shoots and by spreading diseases.
- **(5) Natural Forces:**

  Floods, storms, snow, lightening etc. are the natural forces which damage forests.

Effects of Deforestation

- Forests are closely related with climatic change, biological diversity, wild animals, crops, medicinal plants etc.
- **Large scale deforestation has many far-reaching consequences:**
- (a) Habitat destruction of wild animals (tree using animals are deprived of food and shelter.)
- (b) Increased soil erosion due to reduction of vegetation cover.
- (c) Reduction in the oxygen liberated by plants through photosynthesis.
- (d) Increase in pollution due to burning of wood and due to reduction in CO_2 fixation by plants.

- (e) Decrease in availability of forest products.
- (f) Loss of cultural diversity
- (g) Loss of Biodiversity: along with that genetic diversity is eroded.
- (h) Scarcity of fuel wood and deterioration in economy and quality of life of people residing near forests.
- (i) Lowering of the under ground water table due to more run-off and increased use resulted the frequency of droughts.
- (j) Rise in CO_2 level: cause global warming and enhance melting of ice caps and glaciers and consequent flooding of coastal areas.

Deforestation due to Mining activity

- Mining operations for extracting minerals and fossil fuels like coal often involves removal of vast forest and vegetation areas.
- More than 80,000 ha of land under the stress by mining activities
- This results ruining the topography and destruction of the landscape in the area.
- Large scale deforestation in Mussorie and Dehradun valley due to mining declined at an average rate of 33%
- Mining in forests of Goa since 1961 has destroyed more than 50,000 ha of forest land.
- Coal mining in Jharia, Raniganj and Singrauli areas have caused extensive deforestation in Jharkhand.
- The rich forests of Western Ghats are also facing the same threat due to mining projects for excavation of copper, chromite, bauxite and magnetite.

Dams and their Effects on and Tribal People

- India has more than 1550 large dams, Maharashtra (more then 600), Gujarat (more then 250) and Madhya Pradesh (130). The highest one is Tehri dam, on river Bhagirathi in Uttaranchal and the largest in terms of capacity is Bhakra dam on river Satluj in H.P.
- For building big dams, large scale devastation of forests takes place which breaks the natural ecological balance of the region.
- Floods ,droughts and landslides become more prevalent in such areas.
- Loss floura furna, medicinal plant
- Lost wild life habitat
- Tribal people displaced, Vector borne disease increases , Vulnerable of earth quack


Thank
you!

Management Topic in Environmental Studies)

B. Tech 7TH Semester

Mineral Resources

Unit 2

Natural Resources

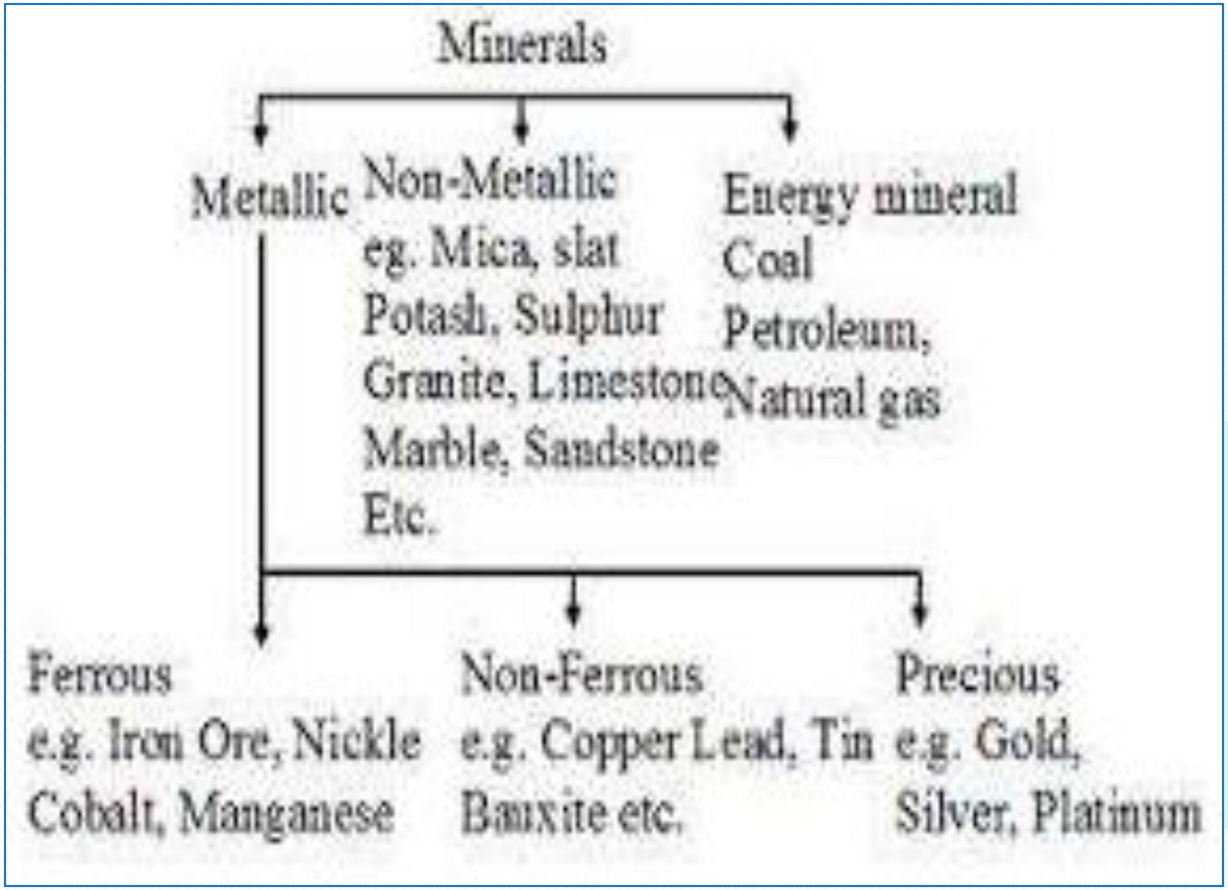
Department: Chemistry
Subject: MTES (CHM2049)

Contents

- Introduction to Mineral resources
- Classification of minerals
- Uses and exploitation of mineral resources
- Major reserves and important uses of some of the major metals
- Major Minerals of India
- Environmental impacts of mineral extraction and use
- Major mines causing severe Environmental problems
- Impacts of mining
- Remedial measures

Introduction

- Minerals are naturally occurring, inorganic, crystalline solids having a definite chemical composition and characteristic physical properties.



Critical minerals: are essential for the economy of a nation
e.g. iron, aluminium, copper, gold etc.

Strategic minerals: required for the defence of a country e.g. Uranium, Manganese, cobalt, platinum, chromium Vanadium, tungsten, molybdenum, cobalt etc.

Uses and exploitation

- The main uses of minerals are as follows:
- (i) Development of industrial plants and machinery.
- (ii) Energy Source: coal, lignite, uranium.
- (iii) Construction, housing, settlements.: Iron,
- (iv) Defence equipments-weapons, armaments.
- (v) Transportation means.; Rail, Vehicle
- (vi) Communication- telephone wires, cables, electronic devices.
- (vii) Medicinal system- Ayurvedic/Allopathic System: Ag, Au,Zn
- (viii) Formation of alloys for various purposes (e.g., Bronze, Brass).
- (ix) Agriculture: fertilizers, seed dressings and fungicides (e.g.
- zineb containing zinc, Maneb-containing manganese etc.).
- (x) Jewellery: Gold, silver, platinum, diamond.

Metals and minerals in a Smart Phone

- Copper (16 grams) [1]
- Silver (0.35 grams) [1]
- Gold (0.034 grams) [1]
- Palladium (0.015 grams) [1]
- Platinum (0.00034 grams) [1]
- Ceramic magnetic switches containing rare earths [2]
- Indium[2]
- Titanium dioxide [2]
- Indium tin oxide [2]

- [1] source – USGS http://pubs.usgs.gov/fs/2006/3097/
- [2] source – NRC critical minerals report

resources

Major uses of some non-metalic minerals

Non-metal Mineral	Major Uses
Silicate minerals	Sand and gravel for construction, bricks, paving etc.
Limestone	Used for concrete, building stone, used in agriculture for neutralizing acid soils, used in cement industry
Gypsum	Used in plaster wall-board, in agriculture
Potash, phosphorite	Used as fertilizers
Sulphur pyrites	Used in medicine, car battery, industry.

- Maximum quantity used: Iron and steel (740 million metric tons annually)
- followed by manganese, copper, chromium, aluminium and Nickel.

Major reserves and important uses metals

Metal	Major World Reserves	Major Uses
Aluminium	Australia, Guinea, Jamaica	Packaging food items, transportation, utensils, electronics
Chromium	CIS, South Africa	For making high strength steel alloys, In textile/tanning industries
Copper	U.S.A., Canada, CIS, Chile, Zambia	Electric and electronic goods, building, construction, vessels
Iron	CIS, South America, Canada, U.S.A.	Heavy machinery, steel production transportation means
Lead	North America, U.S.A., CIS	Leaded gasoline, Car batteries, paints, ammunition
Manganese	South Africa, CIS, Brazil, Gabon	For making high strength, heat-resistant steel alloys
Platinum group	South Africa, CIS	Use in automobiles, catalytic converters, electronics, medical uses.
Gold	South Africa, CIS, Canada	Ornaments, medical use, electronic use, use in aerospace
Silver	Canada, South Africa, Mexico	Photography, electronics jewellery
Nickel	CIS, Canada, New Caledonia	Chemical industry, steel alloys

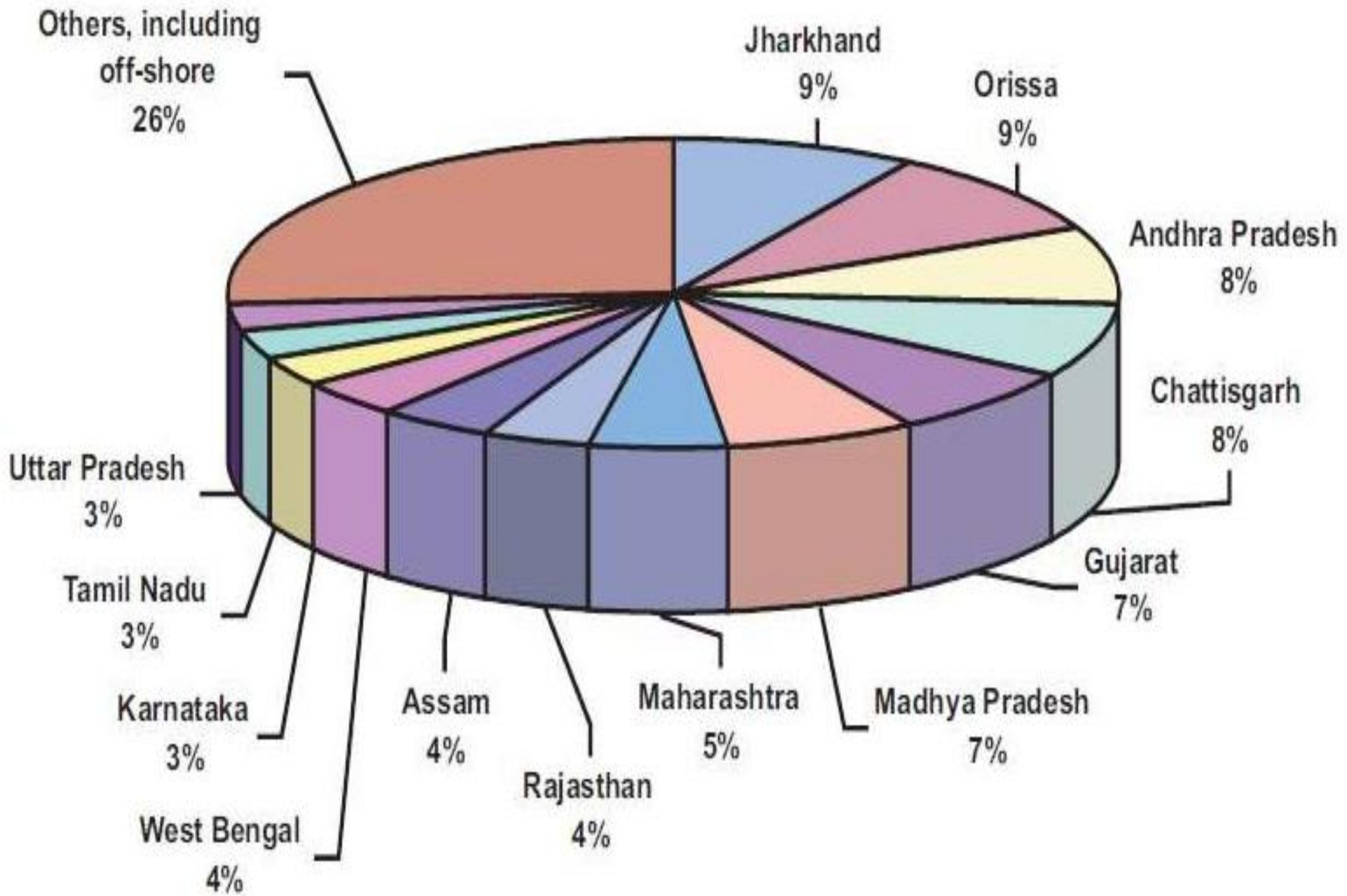
- **Major world reserves of most of the metallic minerals are:**
- USSR, USA, Canada, South Africa and Australia
- Japan virtually no metal reserves

Major Minerals of India

- (a) Energy generating minerals: Coal and lignite: West Bengal, Jharkhand, Orissa, M.P., A.P.
- Uranium (Pitchblende or Uranite ore): Jharkhand, Andhra Pradesh (Nellore, Nalgonda), Meghalaya, Rajasthan (Ajmer).
- (b) Other commercially used minerals Aluminium (Bauxite ore): Jharkhand, West Bengal, Maharashtra, M.P., Tamilnadu.
- Iron (haematite and magnetite ore): Jharkhand, Orissa, M.P., A.P., Tamilnadu, Karnataka, Maharashtra and Goa.
- Copper (Copper Pyrites): Rajasthan (Khetri), Bihar, Jharkhand, Karnataka, M.P., West Bengal, Andhra Pradesh and Uttarnchal.

India is the producer of 84 minerals the annual value of which is about Rs. 50,000 crore

State wise share of minerals Production in India



Production of major metallic minerals in India

Item	Production (Rs. Crore)	% Share
Iron ore	9695.12	75.4
Chromite	1171.68	9.1
Zinc Concentrate	647.29	5.0
Manganese ore	477.48	3.7
Bauxite	303.22	2.4
Copper Concentrate	259.84	2.0
Primary Gold	199.61	1.6
Lead Concentrate	89.37	0.7
Total Metallic Minerals	12858.71	100.0

Mineral Reserves in Odisha

Odisha is the hub of minerals resource in India

Mineral	Reserves (000 Tonnes)	Percentage of Country's Reserves
Bauxite	607997	67.6
Iron ore(hematite)	2251777	32.1
Pyrophyllite	6452200	33.1
Silver ore	1079500	93.1
Limestone	997830	76.9
Chromite	65033	98.3

Major mines causing severe Environmental problems

- i) Jaduguda Uranium Mine: , Jharkhand.exposing local people to radioactive hazards.
- (ii) Jharia coal mines: Jharkhand.underground fire leading to land subsidence and forced displacement of people.
- (iii) Sukinda chromite mines, Orissa. seeping of hexavalent chromium into river posing serious health hazard, Cr^{6+} being highly toxic and carcinogenic.
- (iv) Kudremukh iron ore mine, Karnataka.causing river pollution and threat to biodiversity.
- (v) East coast Bauxite mine, Orissa.Land encroachment and issue of rehabilitation unsettled.
- (vi) North-Eastern Coal Fields: Assam.Very high sulphur contamination of groundwater.

Impacts of mining:

- (i) Devegetation and defacing of landscape: The topsoil as well as the vegetation are removed deforestation leads to several **ecological losses, increase the landscape. prone to soil erosion**.
- (ii) Subsidence of land: Mainly associated with underground mining.

  results in tilting of buildings,

  cracks in houses,

  buckling of roads, sudden change in structure

  bending of rail tracks and

leaking of gas from cracked pipelines leading to serious disasters.

- (iii) Groundwater contamination: pollutes the groundwater
- Sulphur containing ore converted into sulphuric acid through microbial action, thereby making the water acidic which enhances toxic metal leaching posing health hazards.

Impacts of mining:

- (iv) Surface water pollution: The acid mine drainage often contaminates the nearby streams and lakes.

Sometimes uranium, Cr, Pb, Cd, As contamination by mine wastes kill aquatic animals and creating human health hazards.

- (v) Air pollution: Ore, smelting emits air pollutants damaging the vegetation and serious environmental damage and human health hazard .

The suspended particulate matter (SPM),

SOx, soot, arsenic particles,

cadmium, lead etc.

Occupational Health Hazards

Most of the mining worker suffer

- Respiratory and skin diseases due to constant exposure to the suspended particulate matter and toxic substances.

  Suffer by Asbestosis, silicosis, black lung disease etc.
- Statistical data: , on an average, there are 30 non-fatal but disabling accidents per every ton of mineral produced
- one death per 2.5 tons of mineral produced.
- **Remedial measures:**

i) Adopt eco-friendly mining technology: Microbial-leaching technique

- *Thiobacillus ferroxidans* used for extracting gold embedded in iron sulphide ore

  it remove sulphur from ore

Remedial measures

- ii) Restoration of mined areas by re-vegetating: them with appropriate plant species, stabilization of the mined lands, gradual restoration of flora,
- iii) prevention of toxic drainage discharge and need suitable treatment.
- iv) Controlling the standards of air emissions are essential for minimizing environmental impacts of mining.

Thank You
All

Management Topic in Environmental Studies)

B. Tech 7TH Semester

Energy resources

Unit 2

Natural Resources

Department: Chemistry
Subject: MTES (CHM 2049)

Contents

- Introduction to Energy resources
- Growing Energy Demands
- Renewable and Non Renewable Energy
- Solar Energy
- Wind energy, Hydropower
- Tidal energy
- Geothermal and Biomass Energy
- Coal, Petrol, Natural gas, Nuclear power

Energy Resources

- Energy may be defined as the capacity to do work.
- Both energy production and energy utilization are the indicators of a country’s progress as it is a primary input for industrial operation.

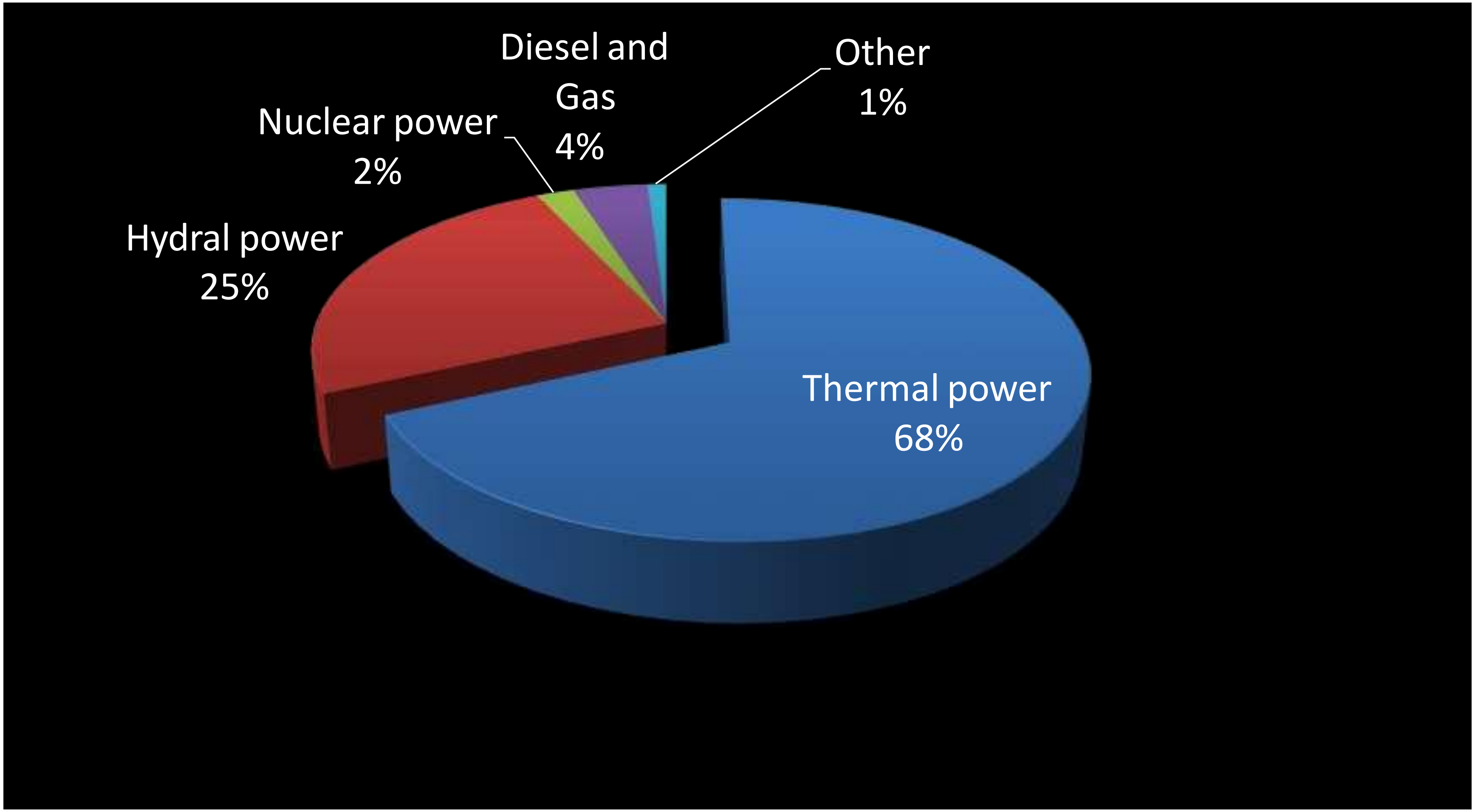
Growing energy needs

- Energy is an important input for development.
- It aims at human welfare covering household ,agricultural transport and industrial complexes.
- Due to the population explosion the demand for various forms of energy has got increased many folds.

U.S.A. and Canada constitute about 5% of the world's population but consume **one fourth** of global energy resources.

An average person there consumes **300 GJ** (Giga Joules, equal to 60 barrels of oils) per year. By contrast, an average man in a poor country like Bhutan, Nepal or Ethiopia consumes less than 1 GJ in a year.

Types of energy consumed



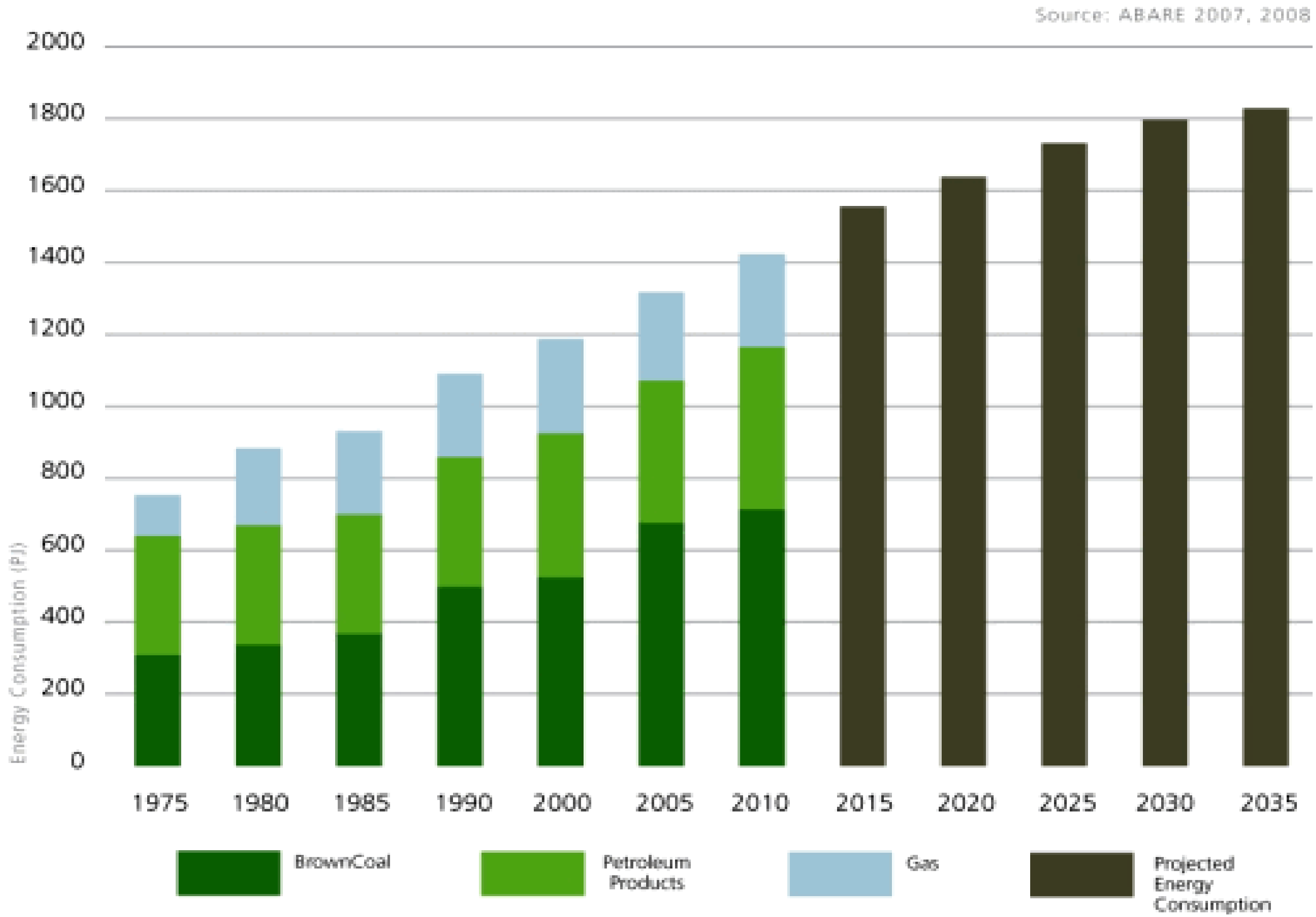
Energy demand

- Indian population is still heavily depend on traditional fuel such as firewood, animal waste and agricultural residue.
- But the share of commercial energy on the total energy demand has been increasing vastly.

Energy consumption (In India, 1990-1991)

Sector	Percentage	Coal	Oil/Natural	Electricity
Industry	51.00	69.96	13.10	17.30
Transport	23.30	9.60	88.90	1.50
Household	13.80	3.90	77.10	19.00
Agriculture	9.60	-	57.10	42.90
Others	2.30	-	29.20	70.80

Growing energy needs



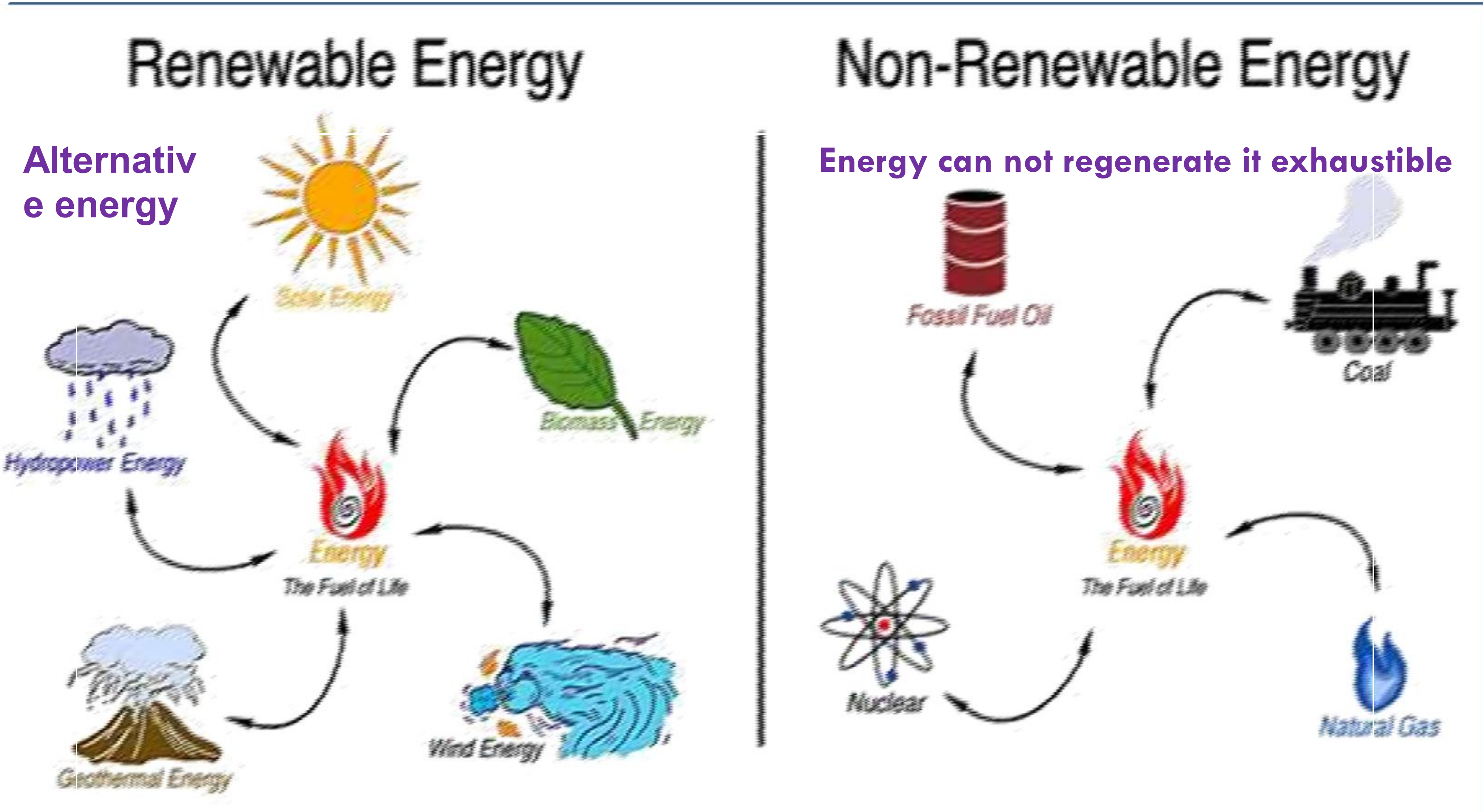
Primary Energy Resources

- Renewable/Inexhaustible/Non-Conventional sources of energy.
- Example : Wood, Solar energy etc

Secondary Energy Resources

- Does occur in nature but are derived from primary energy sources
- Example: Petrol, Hydrogen obtained through electrolysis of water etc.

Types of Energy



Alternative energy

Energy can not regenerate it exhaustible

Renewable resource is a natural resource with the ability to reproduce through biological or natural processes and replenished with the passage of time and are inexhaustible

Solar cells (or) photovoltaic cells (or) PV cells

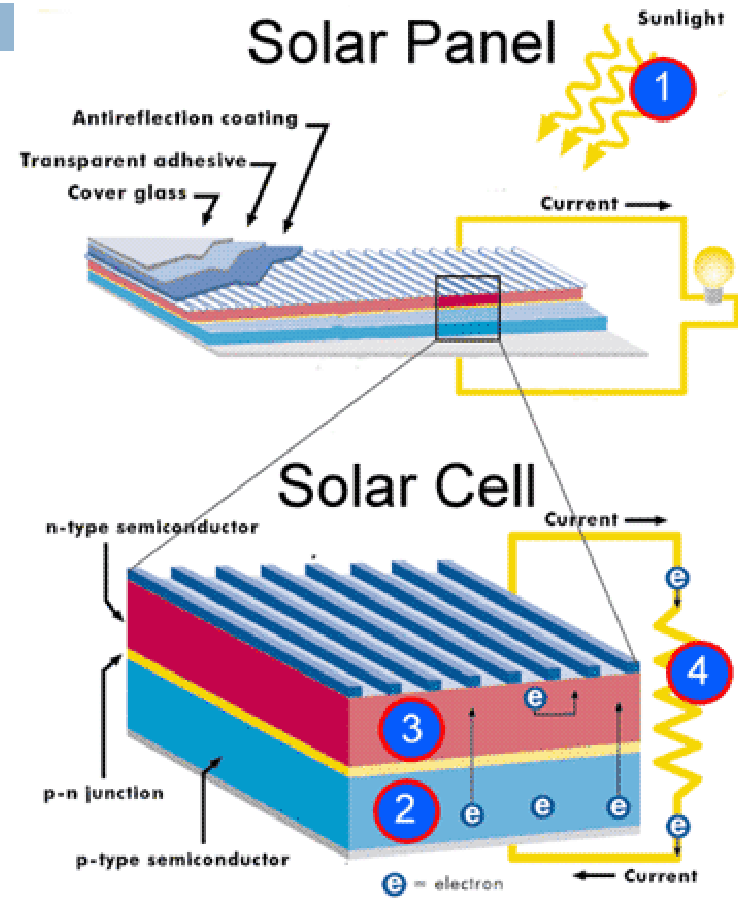
- Solar cells consist of a p-type semiconductor (such as Si doped with B) and n-type semi-conductor (Si doped with P).
- When the solar rays fall on the top layer of p-type semi-conductor, the electrons from the valence band get promoted to the conduction band and cross the p-n junction into n-type semi-conductor.
- There by potential difference between two layers is created, which causes flow of electrons (ie.,an electric current)

Solar cell Uses

- Used in calculators, electronic watches. Street lights, water pumps to run radios and TVs.

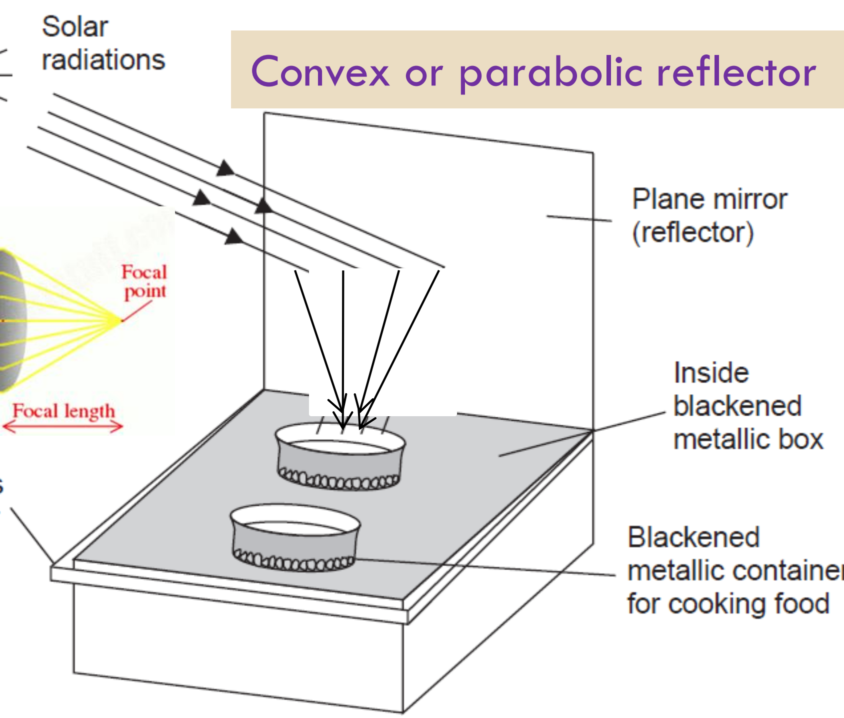
Solar Battery

- When a large number of solar cells are connected in series it form a solar battery.
- Solar battery produce more electricity which is enough to run water pump, to run street-light, etc.,
- They are used in remote areas where conventional electricity supply is a problem.



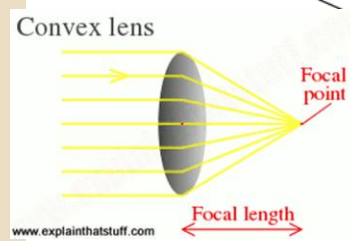
Solar Energy

Solar cooker: Solar cookers make use of solar heat by reflecting the solar radiations using a mirror directly on to a glass sheet which covers the black insulated box within which the raw food is kept



Convex or parabolic reflector

Solar water heater: It consists of an insulated box painted black from inside and having a glass lid to receive and store solar heat. Inside the box it has black painted copper coil through which cold water is made to flow in, which gets heated and flows out into a storage tank.



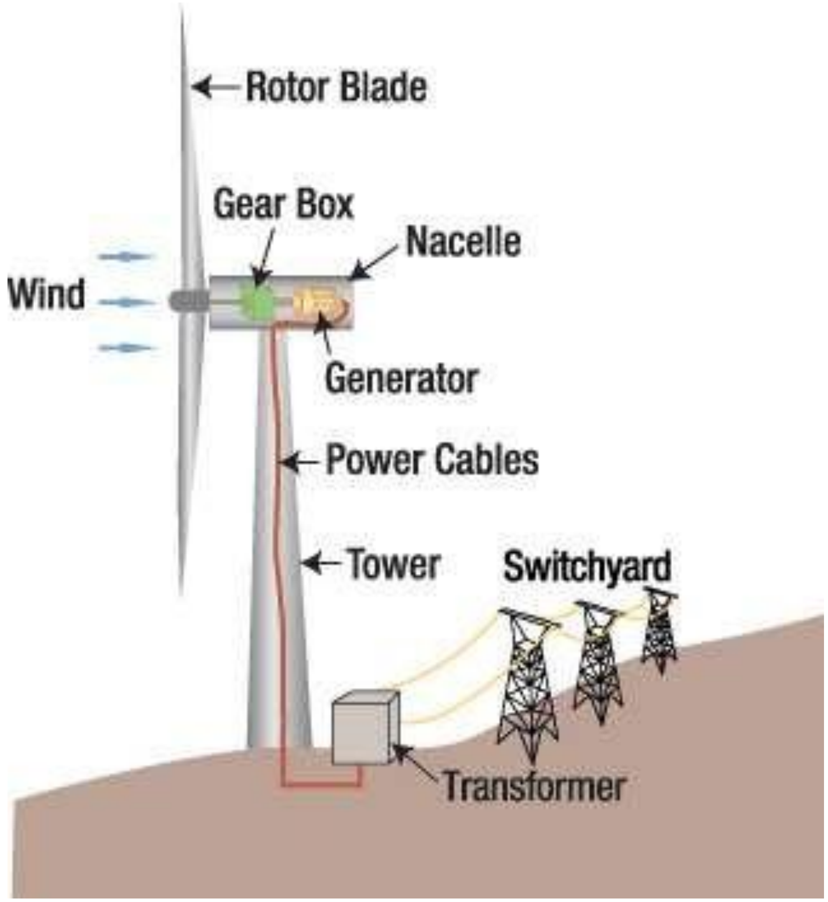
Solar furnace: Here thousands of small plane mirrors are arranged in convex reflectors, all of which collect the solar heat and
produce as high a temperature as 3000°C.

vi) **Solar power plant:** Solar energy is harnessed on a large scale by using convex reflectors which cause boiling of water to produce steam. The steam turbine drives a generator to produce electricity. A solar power plant (50 K Watt capacity) has been installed at Gurgaon, Haryana.

Wind energy

- **Rotor blades** - capture wind's energy and convert it to rotational energy of shaft
- **Shaft** - transfers rotational energy into generator
- **Nacelle** - casing that holds the gear box
- the **gearbox** includes the **generator** which uses rotational energy of shaft to generate electricity.
- **Brakes-** stop rotation of shaft in case of power overload or system failure.
- **Tower** - supports rotor and nacelle and lifts entire setup to higher elevation where blades can safely clear the ground
- **Electrical equipment** - carries electricity from generator down through tower and controls many safety elements of turbine.

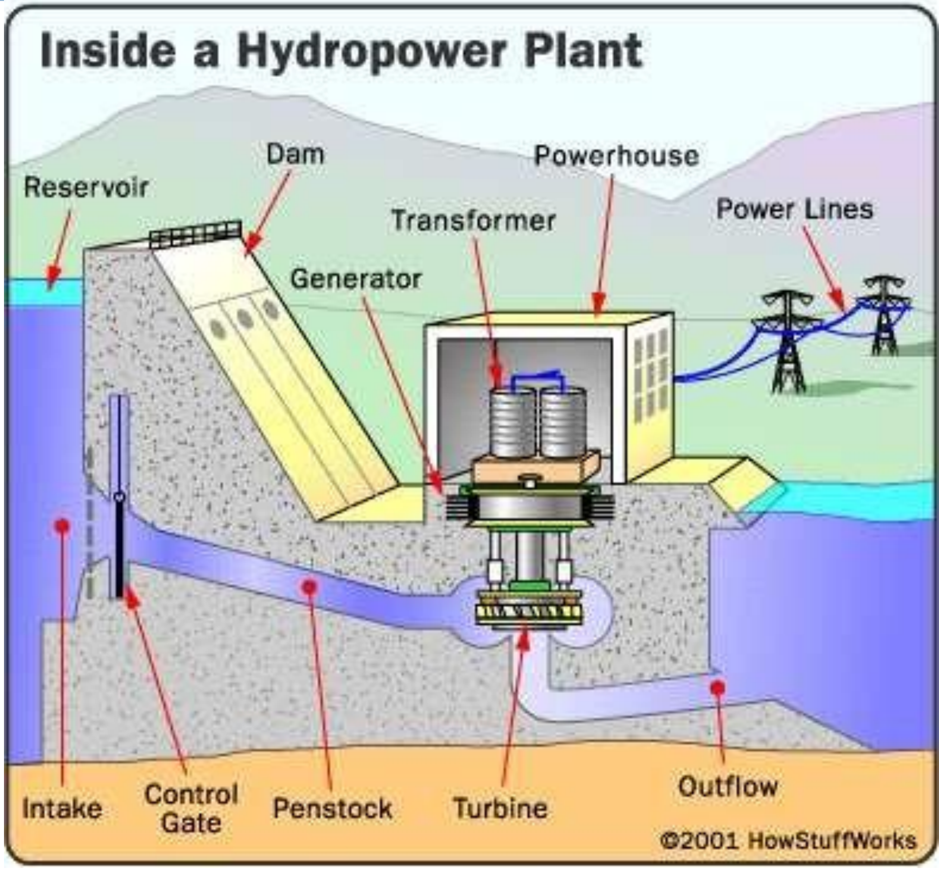
The minimum wind speed required is 15 km/h



The wind power potential of India is estimated to be about 20,000 MW, while at present we are generating about 1020 MW.

Hydro power

- An intake: to diverts of the flow from the water course.
- penstock pipe to convey the water to the turbine.
- Powerhouse: in which the turbine and generator convert the water's energy into electricity.
- Outflow: through which the water is released back to the river or stream.
- Underground cables or overhead lines: to transmit the electricity to it's point of use. These must be short enough to minimize 'voltage drop.'



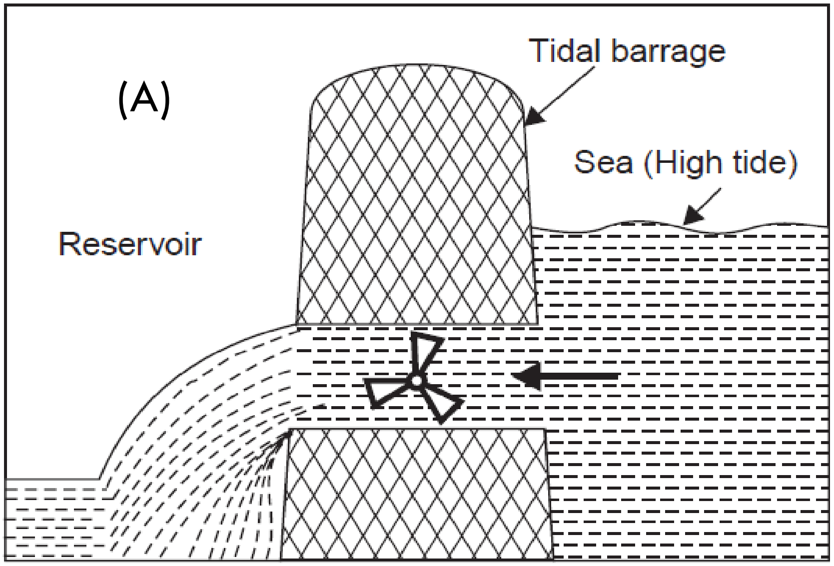
The hydropower potential of India is estimated to be about 4 × 1011 KW-hours.

The Victoria Dam

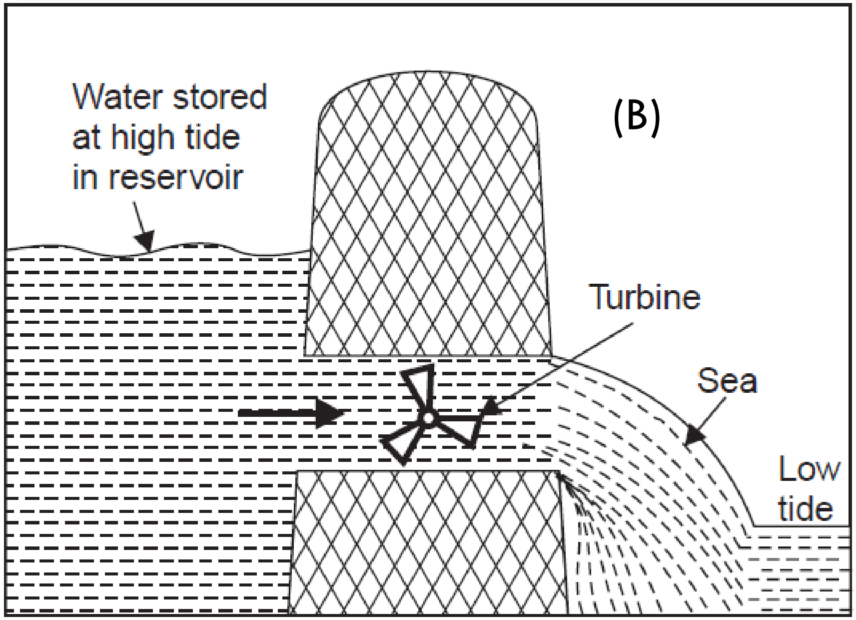
The Upper Kotmale Hydro Power Plant

Tidal Energy

A difference of several meters is required between the height of high and low tide to spin the turbines.
The tidal energy can be harnessed by constructing a tidal barrage.



(A) During high tide, the sea-water flows into the reservoir of the barrage and turns the turbine, which in turn produces electricity by rotating the generators.



(B)During low tide, when the sea-level is low, the sea water stored in the barrage reservoir flows out into the sea and again turns the turbines

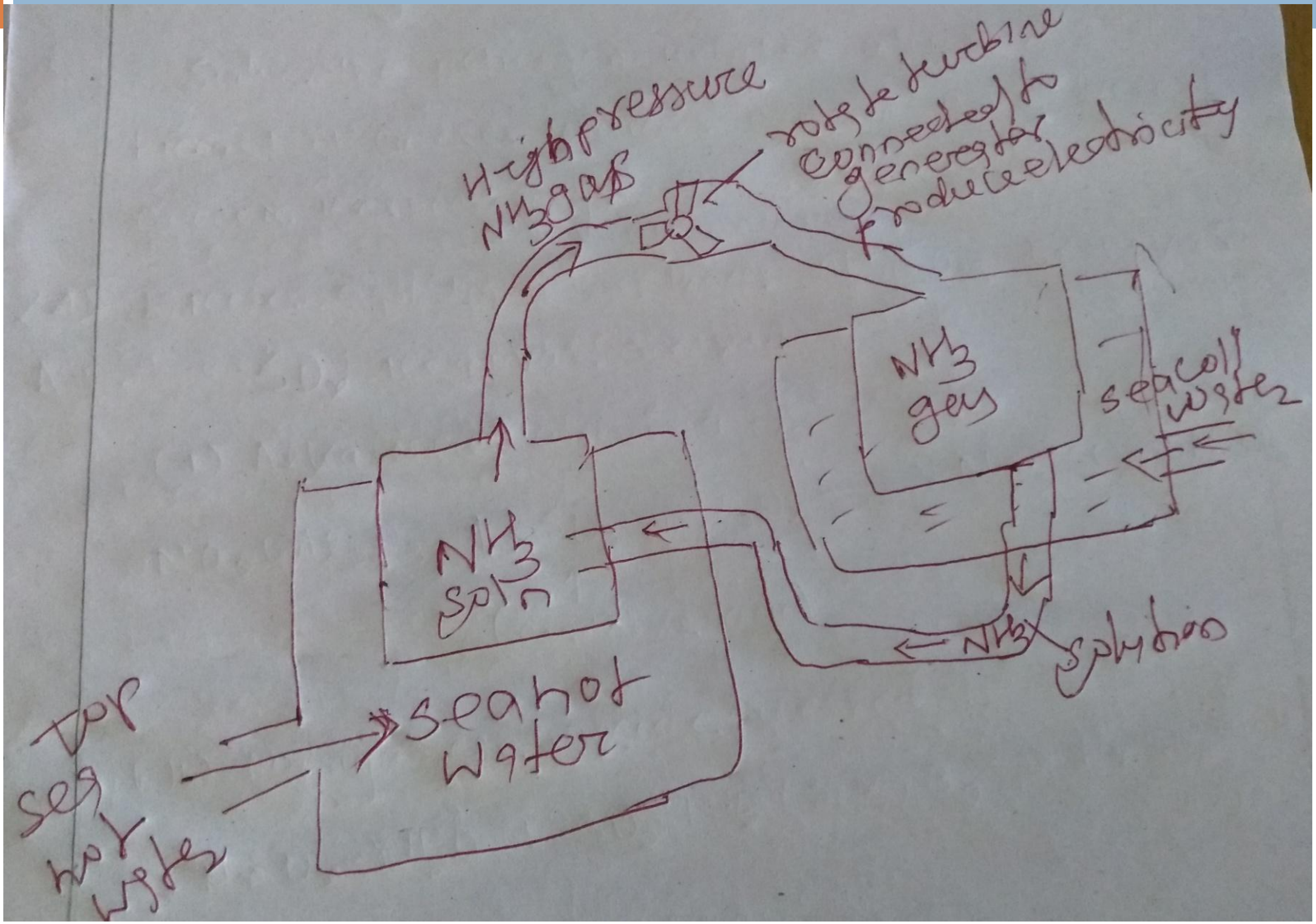
Tidal Energy

- The bay of Fundy Canada having 17-18 m high tides has a potential of 5,000 MW of power generation.
- In India Gulf of Cambay, Gulf of Kutch and the Sunder bans deltas are the tidal power sites.

Ocean thermal energy

- The energy available due to the difference in temperature of water at the surface of the tropical oceans and at deeper levels is called Ocean Thermal Energy. Minimum difference of 20°C needed
- The warm surface water of ocean is used to boil a liquid like ammonia.
- The high pressure NH_3 vapours of the liquid formed by boiling are then used to turn the turbine of a generator and produce electricity.
- The colder water from the deeper oceans is pumped to cool and condense the vapours into liquid.
- Thus, the process keeps on going in cycle continuously for 24 hours a day.

Ocean thermal energy



Geothermal energy

- **Geothermal energy:** The energy harnessed from the hot rocks present inside the earth is called geothermal energy.
- High temperature, high pressure steam fields exist below the earth's surface in many places may be due to fission of radioactive material naturally present in the rocks.
- In some places, the steam or the hot water comes out of the ground naturally through cracks in the form of natural geysers as in Manikaran, Kullu and Sohana, Haryana.
- Artificially drill a hole up to the hot rocks and by putting a pipe in it make the steam or hot water gush out through the pipe at high pressure which turns the turbine of a generator to produce electricity.

In USA and New Zealand, there are several geothermal plants working successfully.

Geo-thermal Energy

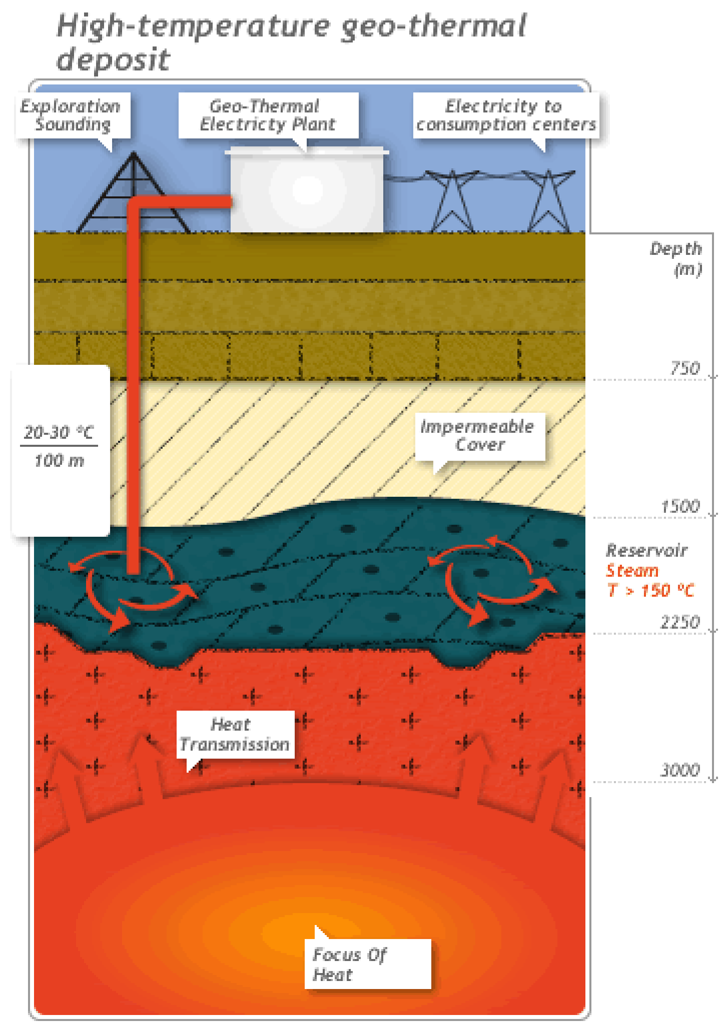
- Temperature of the earth increases at a rate of 20-75^{0}C per km, when we move down the earth surface.
- High temperature and high pressure steam fields exists below the earth's surface in many places.
- The energy harnessed from the high temperature present inside the earth is called geothermal energy.

Natural geysers

- In some places, the hot water (or) steam comes out of the ground through cracks naturally in the form

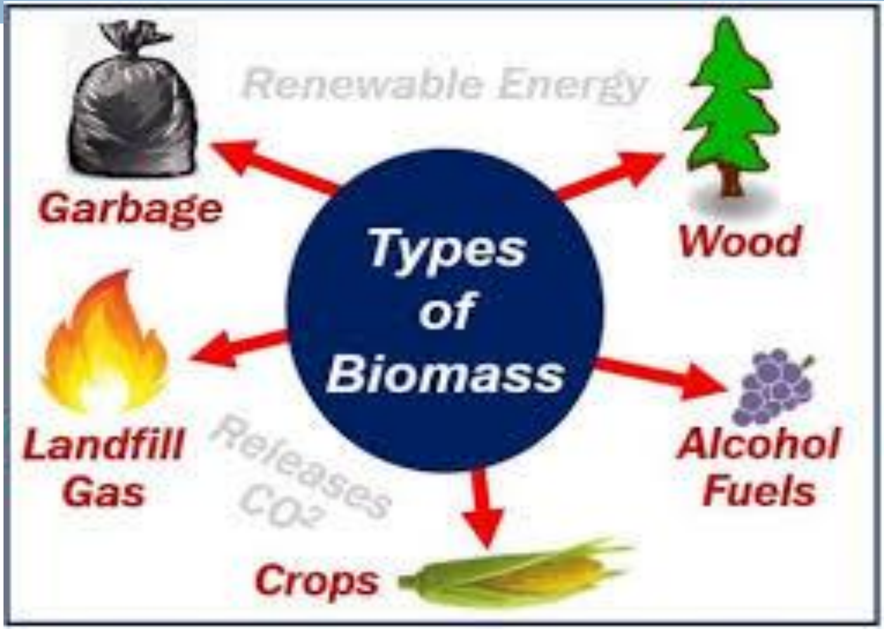
Artificial geysers

- In some places, we can artificially drill a hole up to the hot region and by sending a pipe in it, we can make the hot water or steam to rush out through the pipe with very high pressure.
- Thus, the hot water (or) steam coming out from the natural (or) artificial geysers is allowed to rotate the turbine of a generator to produce electricity.



Biomass Energy

Biomass is the organic matter produced by the plants or animals which include wood, crop residues, cattle dung, manure, sewage, agricultural wastes etc.



Biomass energy Types

(a)Energy Plantations:

- Solar energy is trapped by green plants through photosynthesis and converted into biomass energy.
- Fast growing trees like cottonwood, and Leucaena (Bada chakunda), non-woody crop plants like sugarcane, sweet sorghum and sugar beet, and carbohydrate rich potato, cereal etc. are some of the important energy plantations.

They may produce energy either by burning directly or converted into fuels by fermentation.

Petro-crops

- **(b) Petro-crops**: Certain latex-containing plants like Euphorbias and oil palms are rich in hydrocarbons and can yield an oil like substance under high temperature and pressure.

Gasoline:paraffins, naphthenes, aromatics and olefins

- This oily material may be burned in diesel engines directly or may be refined to form gasoline.
- These plants are popularly known as petro-crops.

Biomass Energy

- **(c) Agricultural and Urban Waste biomass:** Crop residues, bagasse (sugarcane residues), coconut shells, peanut hulls, cotton stalks etc. produce energy by burning.
- Animal dung, fishery and poultry waste and even human refuse are examples of biomass energy
- In Brazil 30 % of electricity is obtained from burning bagasse.
- In rural India, animal dung cakes burnt to produce heat.

Biogas Energy

- Biogas is produced by anaerobic degradation of animal wastes, food waste etc

Anaerobic treatment is a biological process carried out in the absence of O_2 for the stabilization of organic materials by conversion to CH_4 and inorganic end-products such as CO_2 and NH_3

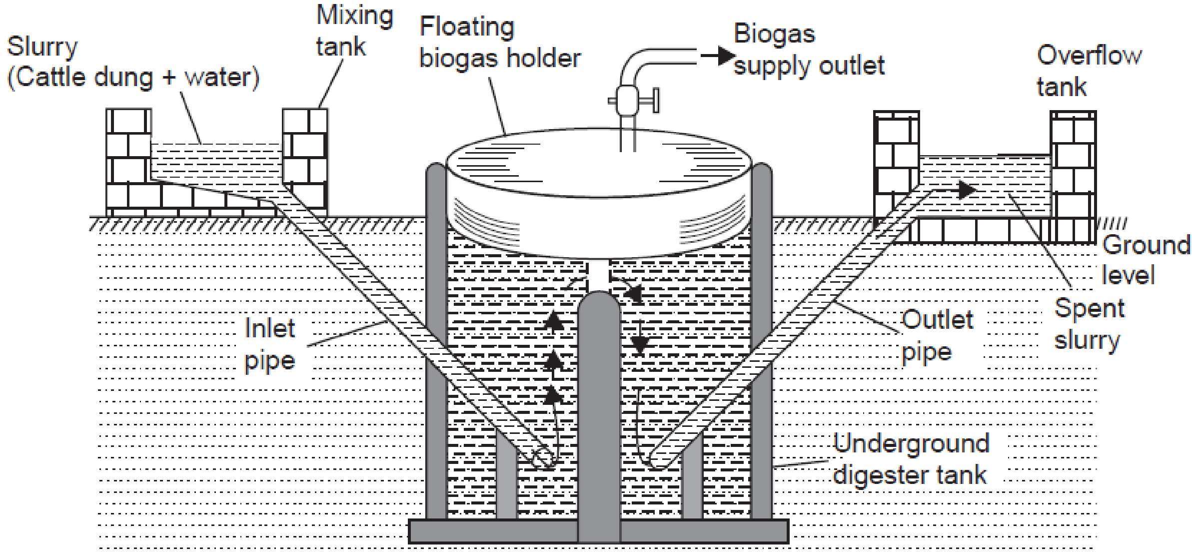


Fig. 2.5.5. Floating gas holder type biogas plant.

Anaerobic microbes
With favorable Temp , pH

Organic materials + Nutrients/Mineral → ***+ CO_2 +NH_3 +H_2O+CH_4+H_2S+Biomass+ End product***

Biofuels Energy

- Biomass (sugarcane) can be fermented (Yeast) to alcohols like ethanol and methanol which can be used as fuels, as compared to petrol its calorific value is less
- Gasohol (mixture of ethanol and gasoline) is a common fuel used in Brazil and Zimbabwe and start trial in India Kanpur.
- Methanol too is a clean, non-polluting fuel. Methanol can be easily obtained from woody plants and ethanol

from grain-based or sugar-containing plants by fermention (Yeast)

Hydrogen Energy

- Highest calorific value, hydrogen can serve as an excellent fuel. Moreover, it is non-polluting
- (i) **Thermal dissociation:** of water (at 3000°K or above) hydrogen (H_2) is produced.
- (iii) **Electrolytic method:** dissociates water into hydrogen (H_2) and oxygen by making a current flow through it.
- (iv) **Photocatalytic methods:** of water involves breakdown of water in the presence of sun light to and semiconducter photocatalyst release hydrogen.
- However, hydrogen is highly inflammable and explosive in nature. Hence, safe handling is required for using H_2 as a fuel. Also, it is difficult to store and transport.

Coal

- Coal is the most abundant fossil fuel in the world.
- **Formation:** The ancient plants along the banks of rivers and swamps were buried naturally or earth quake into the soil and due to the heat and pressure gradually got converted into peat and coal over millions of years of time.

Types

- Anthracite (hard coal), bituminous (Soft coal) and lignite (brown coal).
- Anthracite coal has maximum carbon (90%) and calorific value (8700 kcal/kg.)
- Bituminous, lignite and peat contain 80, 70 and 60% carbon, respectively.
- At the present rate of usage, the coal reserves are likely to last for another 65 years.

India has about 5% of world's coal

Petroleum

- It is the lifeline of global economy. About 1/4thof the oil reserves are in Saudi Arabia.
- At the present rate of usage, the world's crude oil reserves are estimated to get exhausted in just 40 years
- Purified and refined by the process of fractional distillation, obtain petroleum gas, kerosene, petrol, diesel, fuel oil, lubricating oil, paraffin wax, asphalt, plastic etc.
- Petroleum is a cleaner fuel as compared to coal as it burns completely and leaves no residue.

Liquefied Petroleum Gas

- **Liquefied petroleum gas (LPG)**: Butane, propane and ethane.
- The petroleum gas is easily converted to liquid form under pressure as LPG.
- Ethyl mercaptan, added to LPG to check leakage
- Oil fields in India are located at Digboi (Assam), Gujarat Plains and Bombay High, offshore areas in deltaic coasts of Gadavari, Krishna, Kaveri and Mahanadi.

Natural gas

- It is mainly composed of methane (95%) with small amounts of propane and ethane.
- Natural gas deposits mostly accompany oil deposits because it has been formed by decomposing dead animals and plants buried under the earth.
- Natural gas is the cleanest fossil fuel. transported through pipelines easily. It has a high calorific value of about 50KJ/gm and burns without any smoke.
- **World Reservoirs:** Russia (40%), Iran (14%) and USA (7%).
- **India:** Tripura, Jaisalmer, Off-shore area of Mumbai and the Krishna Godavari Delta.
- It is used as a fuel in thermal power plants for generating electricity.
- It is used as a source of hydrogen gas in fertilizer industry and as a source of carbon in tyre industry.

Nuclear energy

Nuclear Fission:

- Nuclear energy is known for its high destructive power as evidenced from nuclear weapons.

Nuclear Fission: nucleus of certain isotopes with large mass numbers are split into lighter nuclei on bombardment by neutrons and a large amount of energy is released through a chain reaction as shown

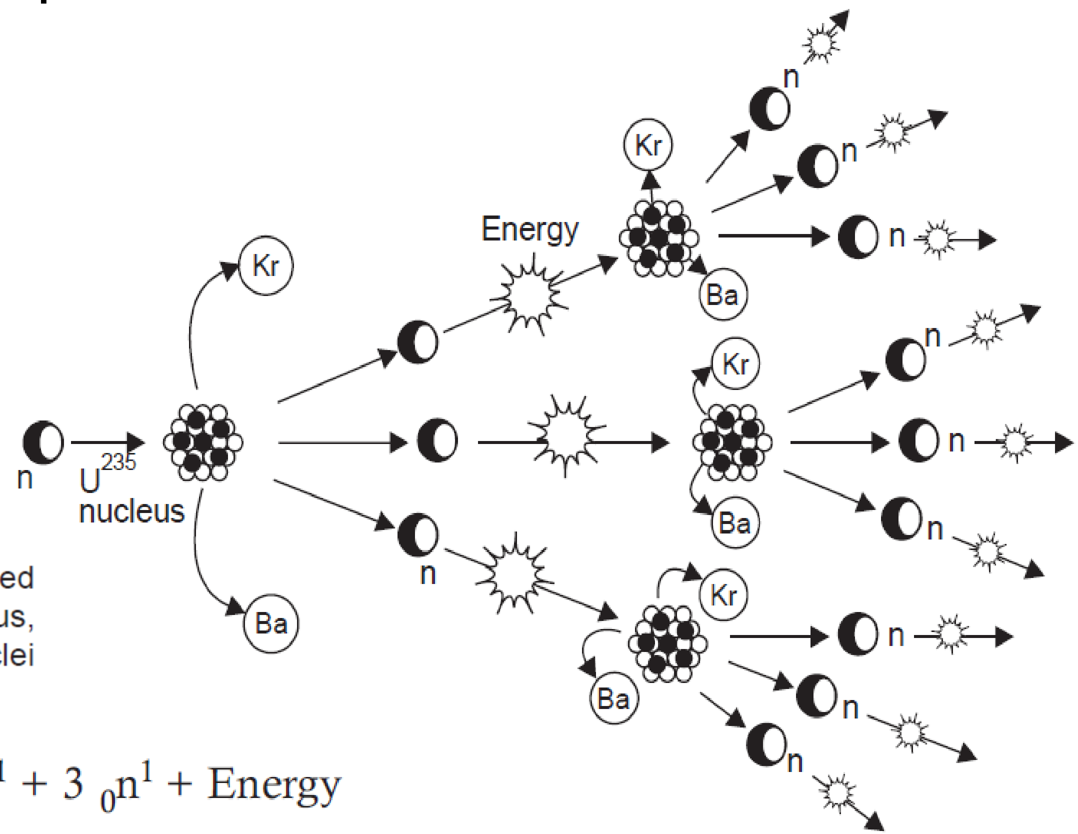


Fig. 2.5.7. (*a*) Nuclear fission—a chain reaction initiated by one neutron that bombards a Uranium (U^{235}) nucleus, releasing a huge quantity of energy, two smaller nuclei (Ba, Kr) and 3 neutrons.

$${}_{92}U^{235} + {}_{0}n^{1} \longrightarrow {}_{36}Kr^{92} + {}_{56}Ba^{141} + 3\ {}_{0}n^{1} + \text{Energy}$$

Nuclear fusion

(ii) **Nuclear fusion:** Here two isotopes of a light element are forced together at extremely high temperatures (1 billion °C) until they fuse to form a heavier nucleus releasing enormous energy in the process.

$${}_1H^2 + {}_1H^2 \longrightarrow {}_3He^2 + {}_0n^1 + \text{Energy}$$

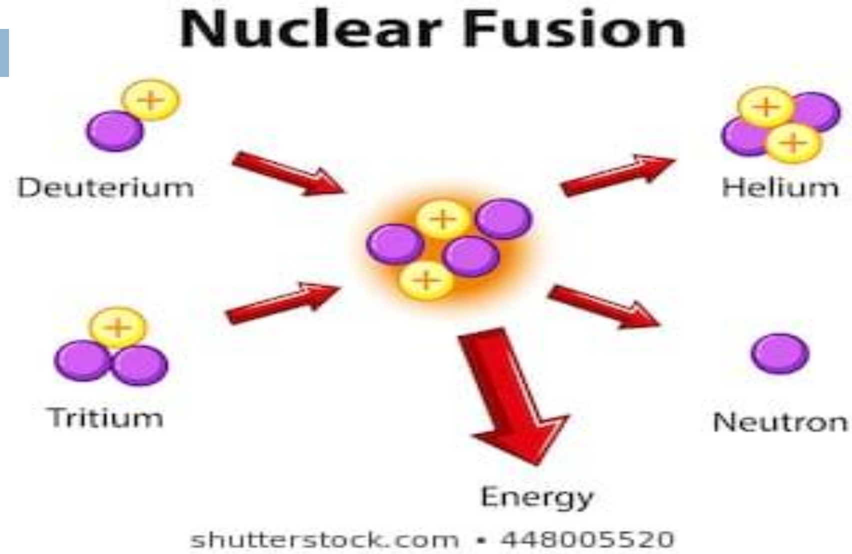


Fig. 2.5.7. (*b*) Nuclear fusion reaction between two hydrogen-2 nuclei, which take place at a very high temperature of 1 billion °C; one neutron and one fusion nucleus of helium-3 is formed along with a huge amount of energy.

One neutron and a huge amount of energy.

$E = MC^2$

$1.674927471 \times 10^{-27}$ X $(3X10^8)^2$

It is difficult to initiate the process but it releases more energy than nuclear fission.

There are four nuclear power stations with an installed capacity of 2005 MW.
These are located at Tarapur (Maharashtra), Rana Pratap Sagar near Kota (Rajasthan), Kalpakkam (Tamil Nadu) and Narora (U.P.).

Nuclear reactor

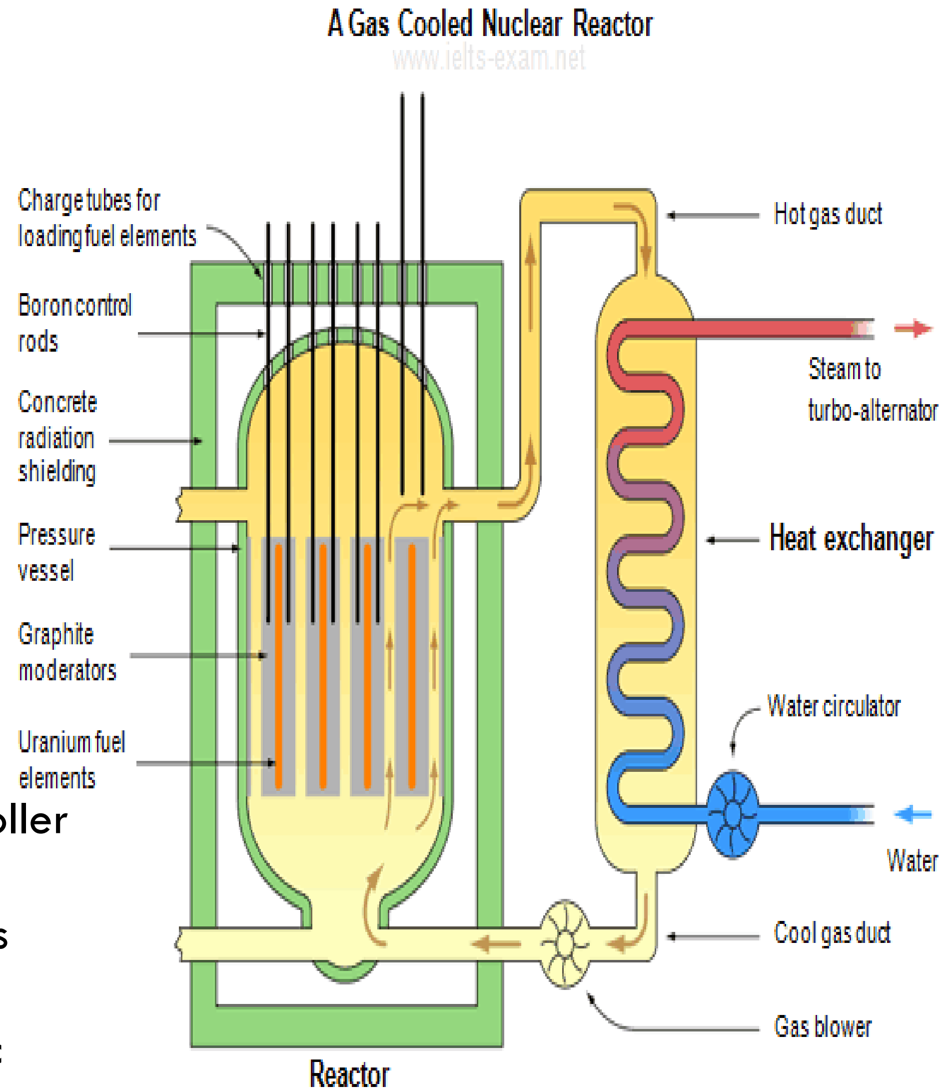
- If each neutron releases two more neutrons, then the number of fissions doubles each generation. In that case, in 10 generations there are 1,024 fissions and in 80 generations about 6 x 10 ^{23} (a mole) fissions.
- A nuclear reactor is a device in which nuclear chain reactions are initiated, controlled, and sustained at a steady rate,

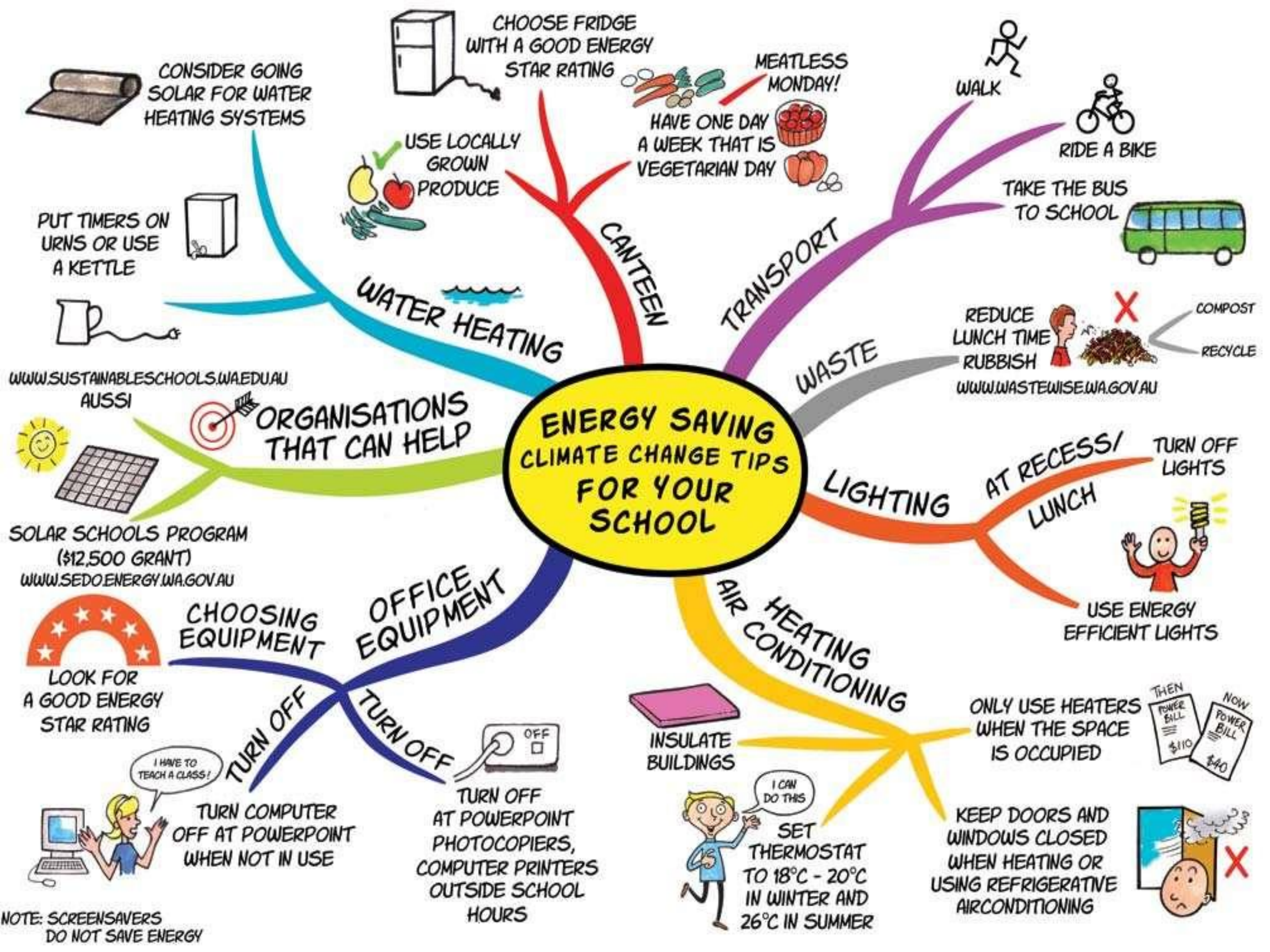
Nuclear bomb, in which the chain reaction occurs in a fraction of a second and is uncontrolled causing an explosion.

Graphite: slow down the newtron and controller is to control the number of neutron

Boron: capable of absorbing many neutrons and control fission

Lead: molten lead or lead-bismuth eutectic coolant also absorb alfa, beta and gamma radiation




ENERGY SAVING CLIMATE CHANGE TIPS FOR YOUR SCHOOL
CANTEEN
CHOOSE FRIDGE WITH A GOOD ENERGY STAR RATING
USE LOCALLY GROWN PRODUCE
MEATLESS MONDAY!
HAVE ONE DAY A WEEK THAT IS VEGETARIAN DAY
TRANSPORT
WALK
RIDE A BIKE
TAKE THE BUS TO SCHOOL
WASTE
REDUCE LUNCH TIME RUBBISH
COMPOST
RECYCLE
WWW.WASTEWISE.WA.GOV.AU
LIGHTING
AT RECESS/ LUNCH
TURN OFF LIGHTS
USE ENERGY EFFICIENT LIGHTS
HEATING AIR CONDITIONING
INSULATE BUILDINGS
ONLY USE HEATERS WHEN THE SPACE IS OCCUPIED
THEN POWER BILL $110
NOW POWER BILL $40
I CAN DO THIS
SET THERMOSTAT TO 18°C - 20°C IN WINTER AND 26°C IN SUMMER
KEEP DOORS AND WINDOWS CLOSED WHEN HEATING OR USING REFRIGERATIVE AIRCONDITIONING
OFFICE EQUIPMENT
CHOOSING EQUIPMENT
LOOK FOR A GOOD ENERGY STAR RATING
TURN OFF
I HAVE TO TEACH A CLASS!
TURN COMPUTER OFF AT POWERPOINT WHEN NOT IN USE
NOTE: SCREENSAVERS DO NOT SAVE ENERGY
TURN OFF
OFF
TURN OFF AT POWERPOINT PHOTOCOPIERS, COMPUTER PRINTERS OUTSIDE SCHOOL HOURS
ORGANISATIONS THAT CAN HELP
WWW.SUSTAINABLESCHOOLS.WA.EDU.AU
AUSSI
SOLAR SCHOOLS PROGRAM ($12,500 GRANT)
WWW.SEDO.ENERGY.WA.GOV.AU
WATER HEATING
CONSIDER GOING SOLAR FOR WATER HEATING SYSTEMS
PUT TIMERS ON URNS OR USE A KETTLE


Thank you

(Management Topic in Environmental Studies)
B. Tech 7^{TH} Semester

Water Resources

Unit 2

Natural Resources

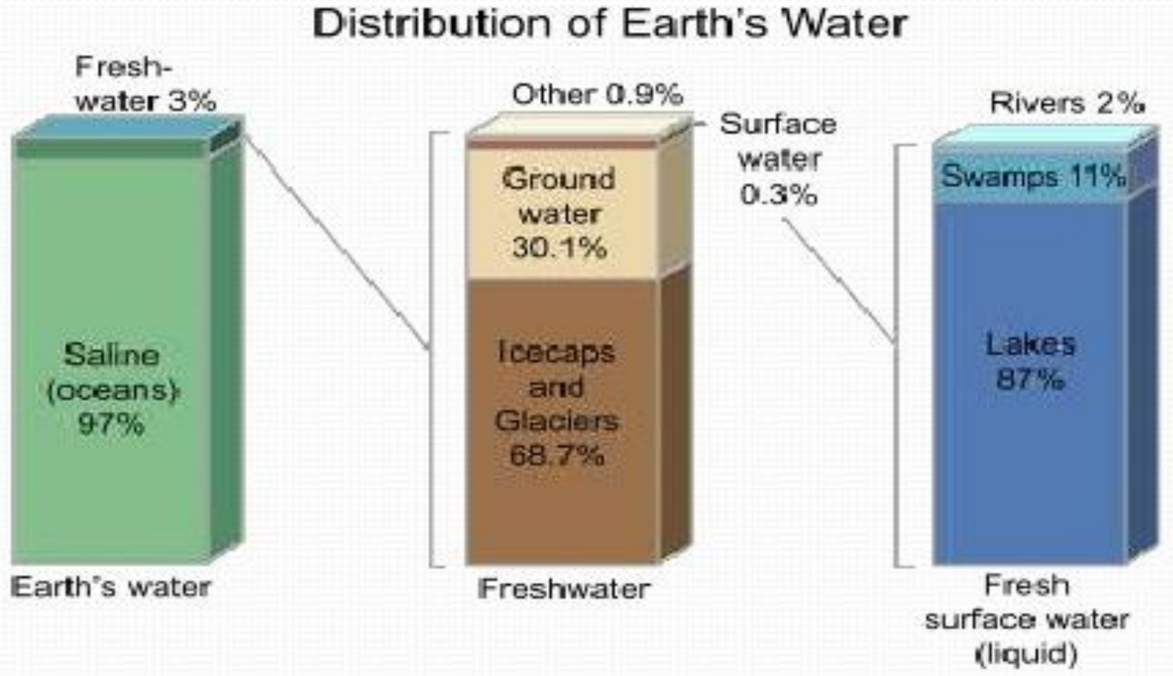
Department: Chemistry
Subject: MTES (CHM2049)

Contents

Water availability

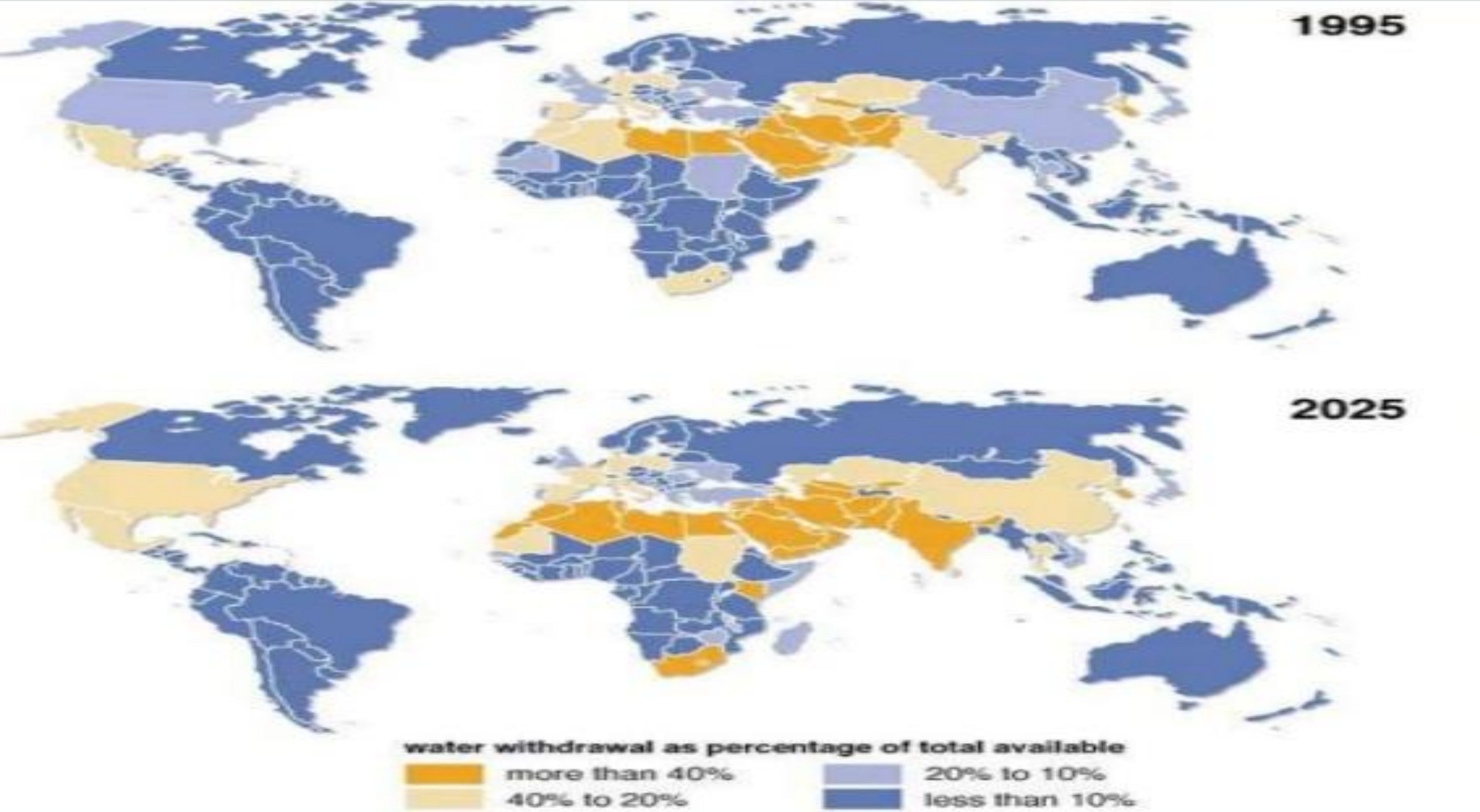
- 70 % land mass in earth under water
- Only 3 % fresh water and 97% saline water
- Out of this 2 % is entrapped in polar ice cap
- 1 % water is the flowing water in rivers, lakes and ground water

India is expected to face critical levels of water stress by 2025



Water Stress & water Scarcity

- **Water Stress:**
  - Annual water supplies is less than 1,700m³ per person.
- **Water Scarcity:**
  - Annual water supplies is less than 1,000m³ per person.
- **Absolute scarcity:**
  - Annual water supplies is less than 500m³ per person.


1995
2025
water withdrawal as percentage of total available
more than 40%
40% to 20%
20% to 10%
less than 10%

Water use in India

Uses of Fresh Water

Types

Agricultural: The 69% of water is use for irrigation.

Industrial: The 15% of water is use for industrial things. The major use of industrial is power plants. Oil refineries which is use with a chemical process. Manufacturing plants which use water as a solvent.

Industrial water is lower than agricultural water.

Household: The 15% of water is use for household. Household uses are:

- Drinking
- Bathing
- Water
- Cooking
- Sanitation
- Gardening

Recreational: Recreational water has a small use. Recreational use is mostly needed for reservoirs. This type of use of water is specific for places and good times.

Environmental water has a small use. Environmental water is use mostly for:

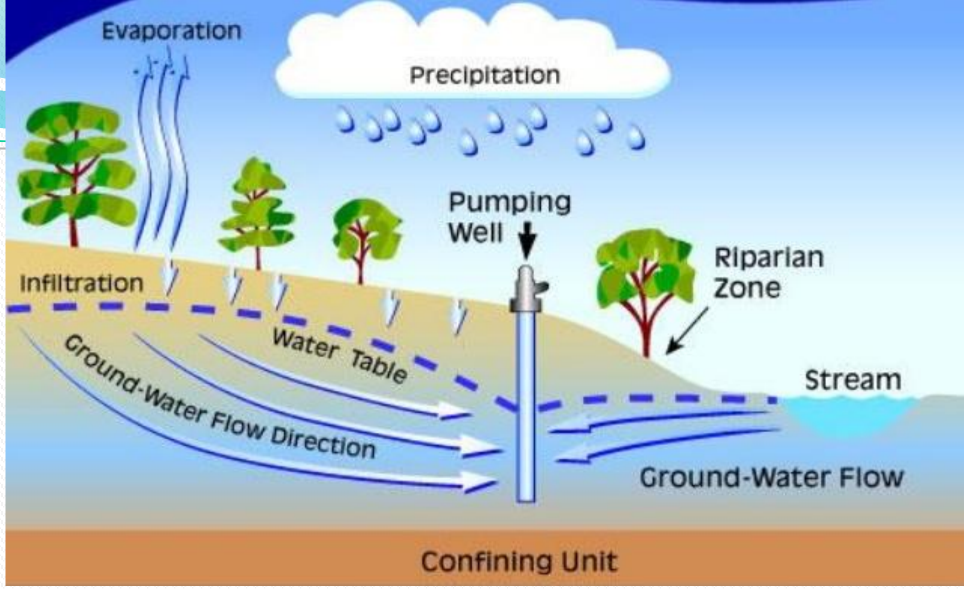
- Artificial wetlands
- Artificial lakes

This is to create a wildlife habitat.

d. Mining

- Water is used for the extraction of minerals that can be in forms of:
  - Solid: coal, iron, gold, sand - etc.
  - Liquid: crude oil.
  - Gas: natural gases.

Hydrological cycles-components



- Evaporation: The transformation of water in to water vapour at all surface at all temperature
- Transpiration: Evaporation of water from vegetative surfaces like plant foliage
- Infiltration: The movement of water into the interior of soil to the ground water regime.
- Precipitation: Water vapour forms cloud and results in precipitation in the form of rain fall and snow fall.
- Run off: The portion of precipitation percolates ground as ground water and the major portion leaves in different stream as run off.
- Precipitation = Evaporation+ Transpiration + Infiltration+ Run off

Hydrological cycle

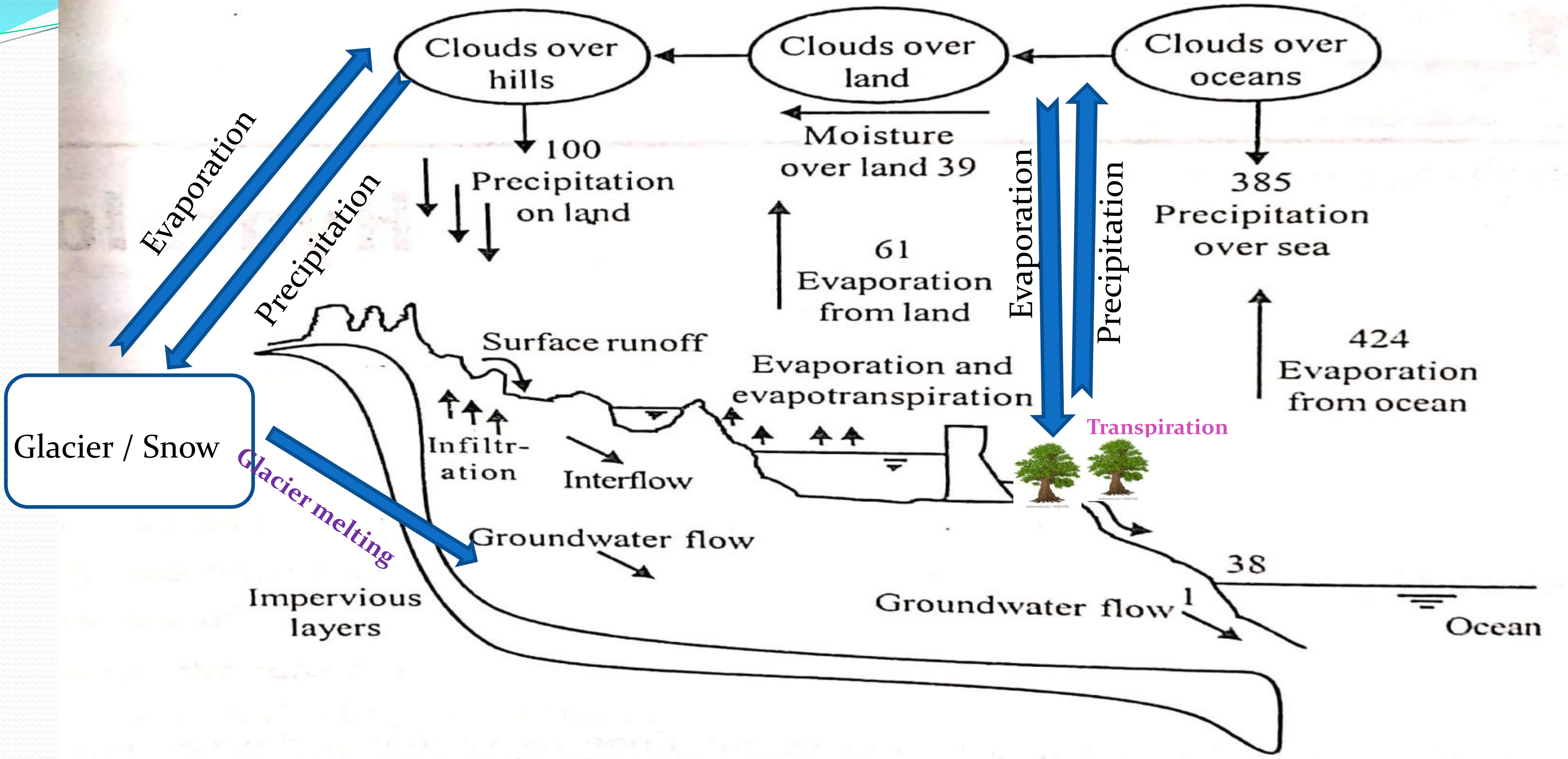


Fig. 4.1 Hydrological cycle with global annual average water balance given in units relative to a value of 100 for the rate of precipitation on land.

FLOODS

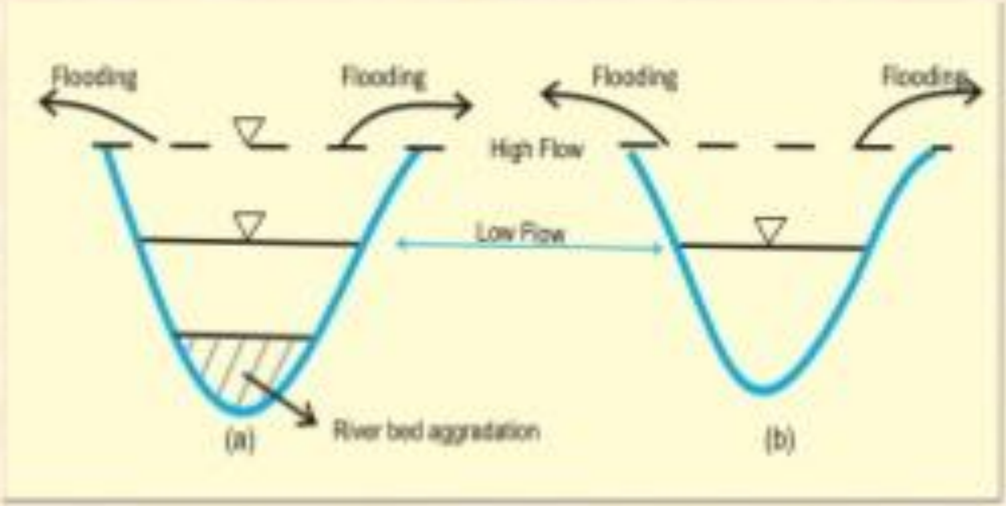
FLOODS ARE NATURAL PHENOMENA.

FLOODS ARE WATER RELATED DISASTER

A flood occurs when the Geomorphic Equilibrium in the river system is disturbed because of intrinsic or extrinsic factors or when a system crosses the geomorphic threshold.

(a) Flooding in a river due to aggradation of river bed (intrinsic threshold);

(b) Flooding in a river due to heavy rainfall (extrinsic threshold)



TYPES OF FLOODS

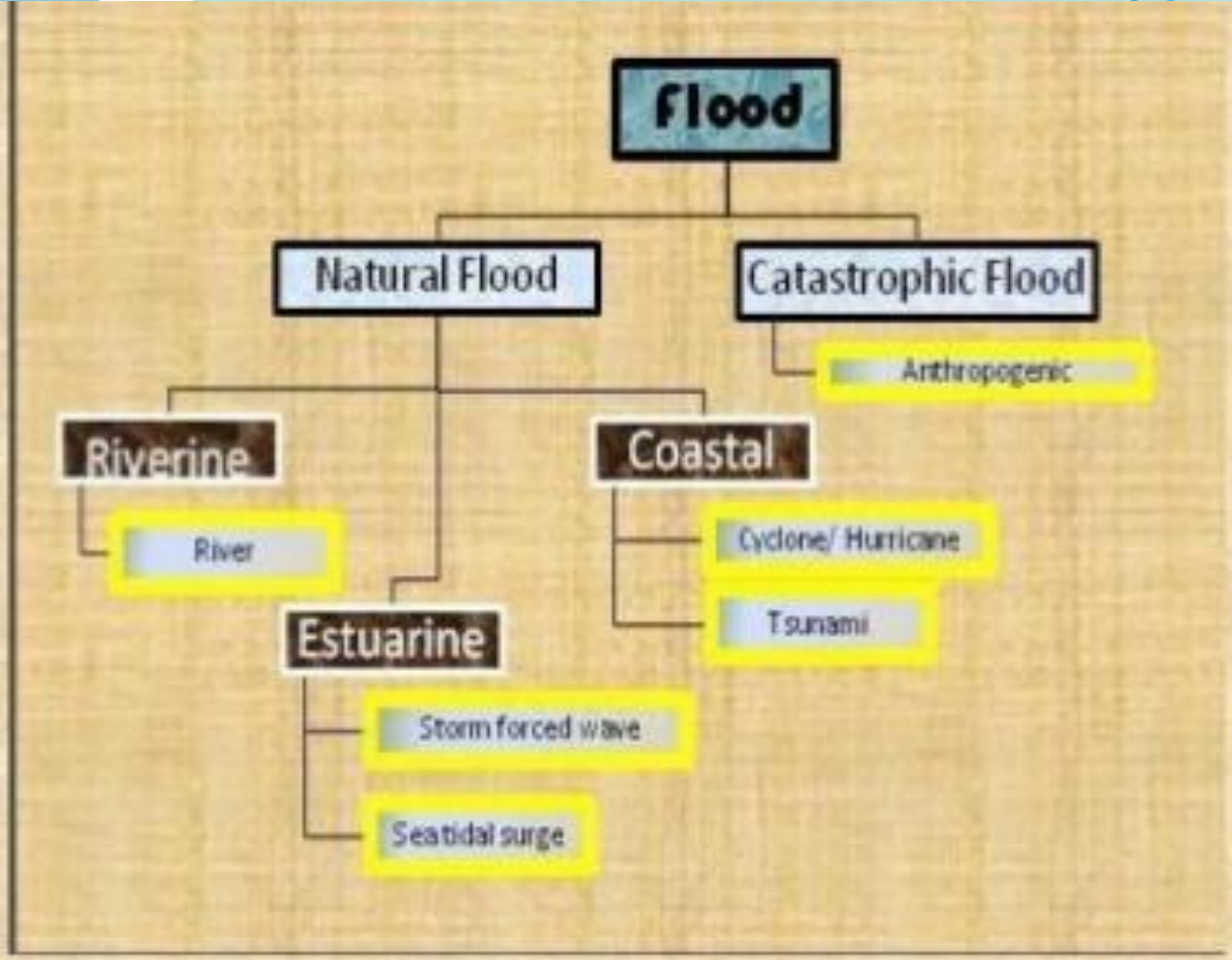
Types of floods
- •Flash floods
- •River floods
- •Coastal Floods
- •Urban Flood

According to their duration flood can be divided into different categories:

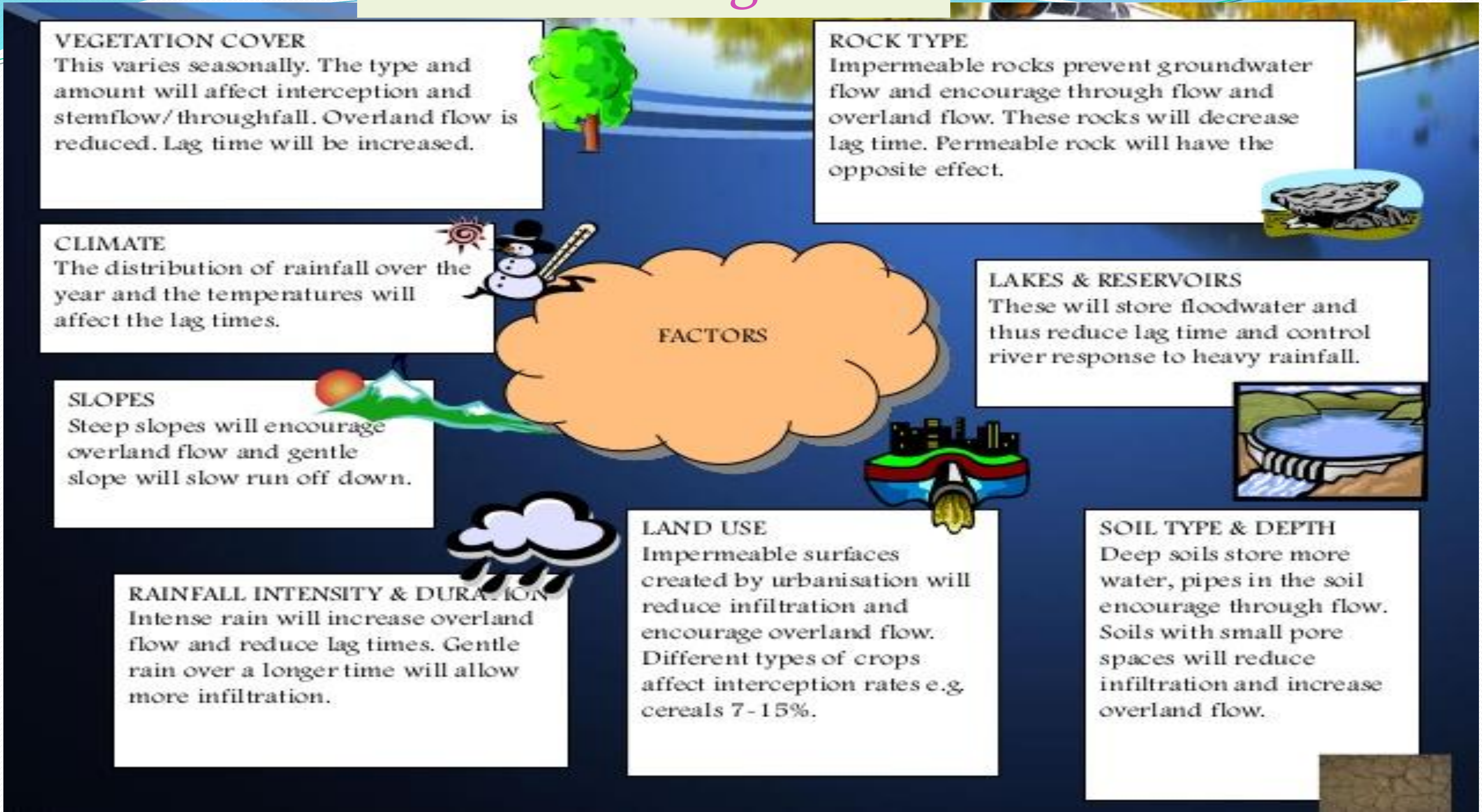
•Slow-Onset Floods: Slow Onset Floods usually last for a relatively longer period, it may last for one or more peeks, or even months.

•Rapid-Onset Floods: Rapid1Onset Floods last for a relatively shorter period, they usually last for one or two days only.

•Flash Floods: Flash Floods may occur within minutes or a fe1w hours after heavy rainfall, tropical storm, failure of dams or levees or releases of ice dams. And it causes the greatest damages to society.



Factor affecting Flood



Impact of Floods

- Human Loss
- Property Loss
- Affects the Major Roads
- Disruption of Air / Train / Bus services
- Spread of Water-borne Communicable Diseases
- Communication Breakdown
- Electricity Supply Cut off
- Economic and Social Disruption
- Increase in Air / Water Pollution

Drought

- It is an unpredictable climatic condition and occurs due to the failure of one or more monsoons.

- Rains are very unpredictable. This leads to periods where there is serious scarcity of water.
- Drought prone areas are faced with irregular periods of famine as farmers have no income.
- Drought prone areas Development Programs:
- Under this scheme, people are given wages in bad years for activities like building roads, minor irrigation works and plantation programs.
- It is a major problem in arid and semi arid regions.
- Drought affects home, agriculture, industry, leads to malnutrition problems in children due to food shortages

Causes of Drought

Natural / Physical causes:

- Weather: increased amount of *anticyclone* weather (hot + dry) means air holds less moisture so you get less rain
- Global warming: weather patterns change (e.g. Sahel is becoming hotter + drier)
- Hotter weather = more evaporation than precipitation
- El Nino: random weather event that reverses normal weather patterns (e.g. Australia has years of drought + then years of flood)

Human causes:

- Overpopulation: too many people living in an area using too much water
- Overcultivation: planting too many crops which use up too much water
- Overextraction: removing too much water from wells so they dry up
- Deforestation: cutting down trees which otherwise store water + hold soil together
- Politics: fighting over water, or companies being greedy + taking too much water to then sell on

Causes of Drought

- Major factor responsible for drought is deforestation.
- Due to denuded forest cover the rainwater rushes down the river and is lost.
- Forest cover permits the water to remain in the same area and gradually seep into the ground.
- This charges the underground stores of water in natural aquifers. Which later can be use during the period of no monsoons.

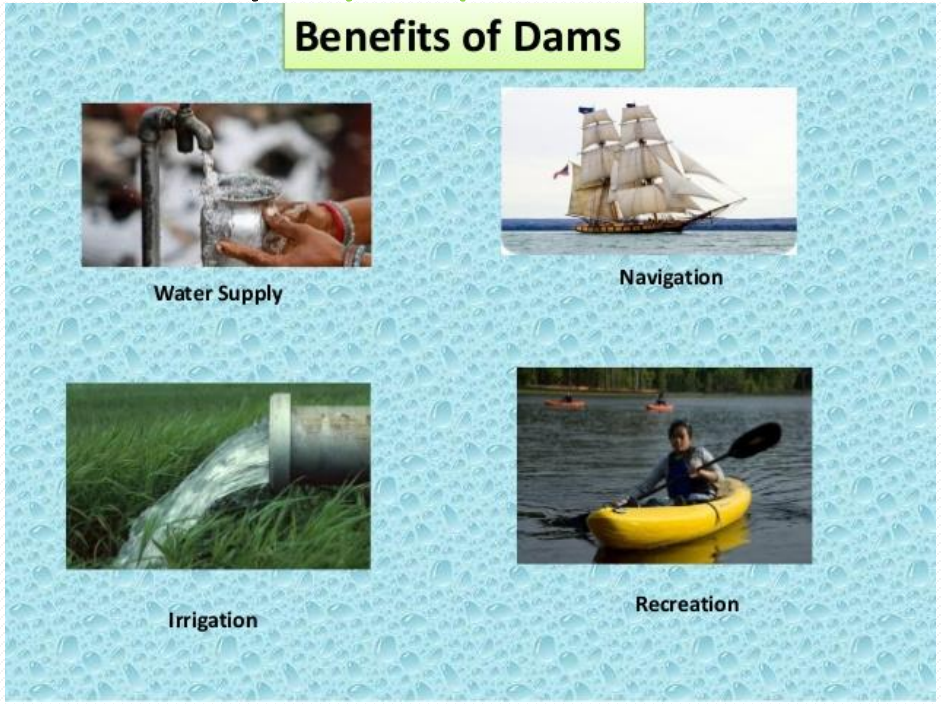
Soil and water management and afforestation are long-term measures that reduce the impact of droughts

Advantages with reservoirs/dams

India's increasing demand for water for intensive irrigated agriculture, for generating electricity, and for consumption in urban and industrial centers, has been met by creating large dams.

The major advantages of Dams are

- Water supply to intensive irrigated agricultural land
- Generation for cheap and non-polluting source of electricity, Hydropower
- Water supply to cash crops
- Domestic water supply
- Water supply to big industries
- Fishing activities



Problems with reservoirs/dams

- Submergence of forest land with valuable loss to biodiversity
- Sediment deposition in rivers lead to flood and soil erosion
- Serious impacts on riverine ecosystems.
- Displacement of tribal people.
- Water logging and salinity of surrounding lands leading to infertility of the soil.
- Dislodging animal populations, damaging their habitat and cutting off their migration routes.
- The emission of green house gases from reservoirs due to rotting vegetation

Changes to Earth's Rotation

NASA geophysicist Dr. Benjamin Fong Chao have found evidence that large dams cause changes to the earth's rotation, because of the shift of water weight from oceans to reservoirs. Because of the number of dams which have been built, the Earth's daily rotation has apparently sped up by eight-millionths of a second since the 1950s. Chao said it is the first time human activity has been shown to have a measurable effect on the Earth's rotation.

Sustainable water management

Make people aware of the dangers of water scarcity.

Measure for sustainable water management

- Building several small reservoirs instead of few mega projects
- Develop small catchment dams and protect wetlands
- Soil management, micro catchment development and afforestation permits recharging of underground aquifers thus reducing the need for large dams.
- Treating and recycling municipal waste water for agricultural use.
- Preventing leakages from dams and canals.
- Preventing loss in Municipal pipes.
- Effective rain water harvesting and ground water recharging.
- Water conservation measures in agriculture such as using drip irrigation.
- Pricing water at its real value makes people use it more responsibly and efficiently and reduces water wasting.
- In deforested areas where land has been degraded, soil management by bunding along the hill slopes and making ‘nala’ plugs, can help retain moisture and make it possible to re-vegetate degraded areas


Thank you!