

ASSIGNMENT

1) Scope of environmental studies:

- Provides the knowledge about ecological systems and biodiversity
- Provides necessary information about biodiversity richness and the potential dangers to the species of plants, animal and microorganism in the environment.
- Enables to understand the cause and consequences due to natural and man induced disasters (flood, earthquake, landslide, etc)
- It teaches the citizen the need of / for sustainable utilization of resources.

Importance of environmental studies:

- helps to maintain ecological balance by providing a basic operating knowledge of environmental system and processes
- Help to achieve sustainable development and understand the relationship between development and the environment
- The concepts from environmental studies can be applied to the study of agriculture and the design of sustainable production system
- It deals with the analysis of the processes in water, air, land, soil and organism which leads to pollution.

2) "Environment studies is multidisciplinary in nature"

Environmental studies combines knowledge from many fields like biology, chemistry, physics, geography, economics, sociology and political science to understand the relationship between humans and the environment. It is multidisciplinary because solving environmental problems needs ideas from science, technology, social studies and economics together.

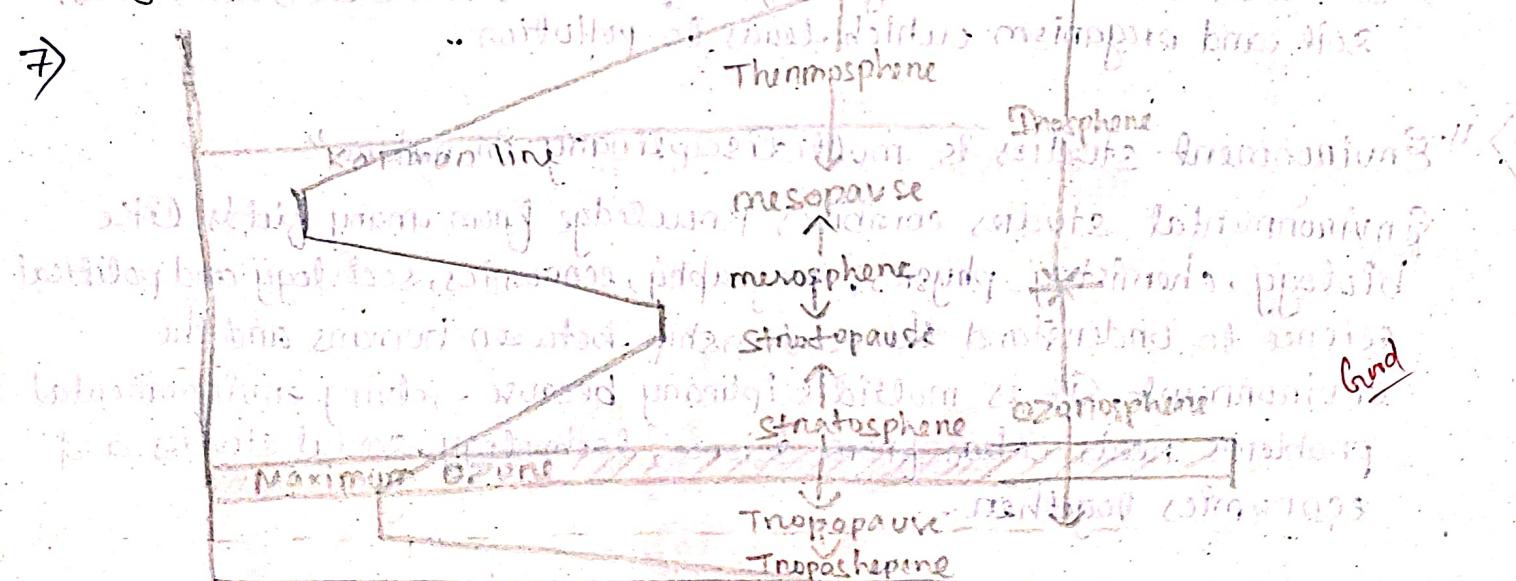
3) Major Consequences of deforestation:

- Loss of biodiversity (plants & animals)
- soil erosion and loss of fertility
- Increase in global warming due to higher CO₂ levels
- Disturbance of water cycle and rainfall pattern
- Desertification & climate imbalance

- 4) The upstream problems related to Dam Project in India:
- ⇒ Submersion of forests, villages and agriculture land
 - ⇒ Displacement of local people and loss of livelihood
 - ⇒ Waterlogging and soil salinity near reservoirs
 - ⇒ Loss of wildlife habitats and biodiversity
 - ⇒ Changes in natural river flow affecting ecosystems.

- 5) Environmental Impact of Mining projects:
- ⇒ Destruction of land and vegetation.
 - ⇒ Air and water pollution from dust and chemicals
 - ⇒ Soil erosion and loss of fertility
 - ⇒ Noise pollution from blasting and machinery
 - ⇒ Displacement of communities and wildlife

- 6) Conservation of energy means using energy efficiently and reducing wastage. It includes using renewable sources like solar, wind and hydropower, promoting energy-efficient appliances, recycling and spreading awareness to save non-renewable resources for future generations.



- ⇒ Troposphere:
- bottom layer of the atmosphere that stretches about 11km
 - Contains 75% of the air
 - Temperature decreases with altitude
 - made up of N_2 & O_2 (mostly)
 - Storms & rainfall take place

- ⇒ Stratosphere:
- 2nd 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 UV rays

→ Mesosphere :

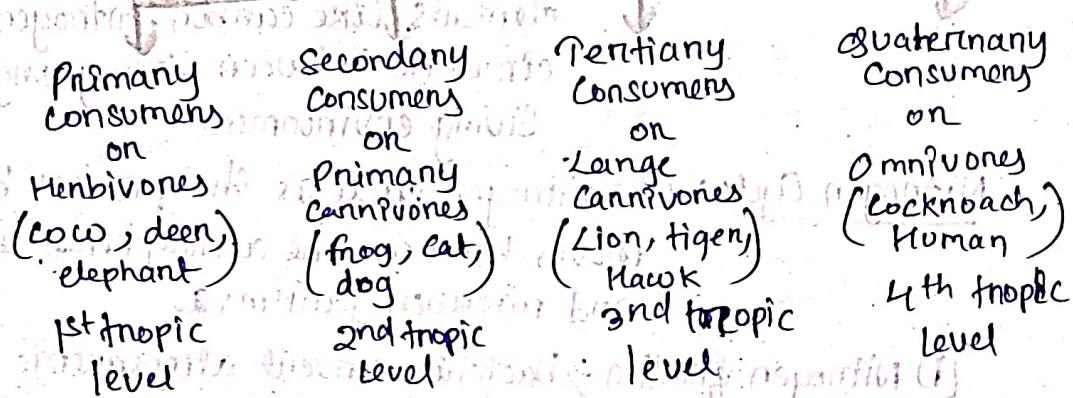
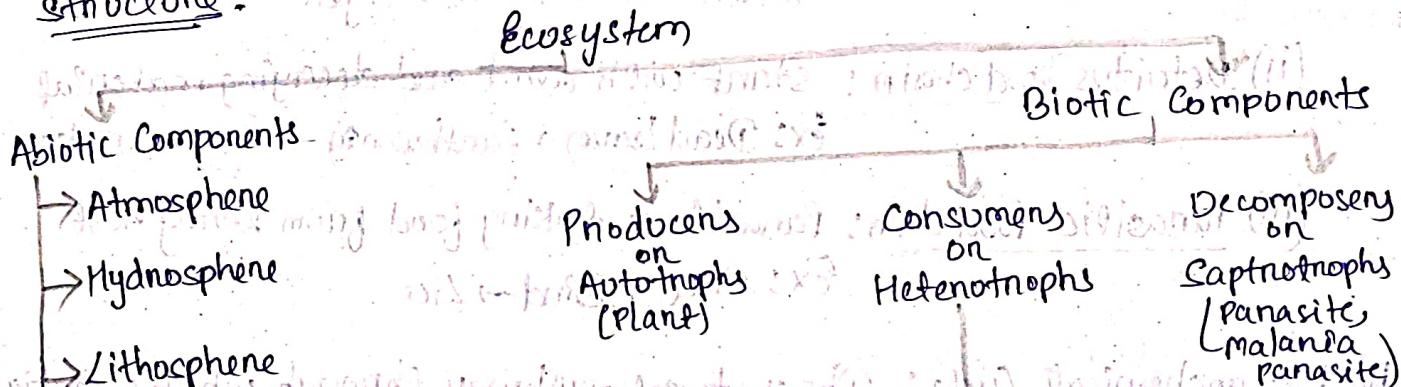
- 3rd layer of the atmosphere that extends up to 80km
- Temperature decreases with altitude
- The coldest layer
- here most meteors burn up

→ Thermosphere :

- 4th layer of the atmosphere that stretches about 1000km
- It's 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

8) An ecosystem is a system where living organisms interact with each other and with their physical environment (air, water, and soil). It maintains a delicate balance through the flow of energy and cycling of nutrients.

Structure:



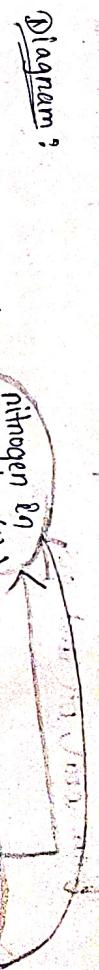
functions:

- Primary function : Photosynthesis
- Secondary function : Transfer of energy to all consumers

→ Pertaining function: food chain, food webs and trophic structure
 → Nutrients flow (Biogeochemical cycles)
 → Ecosystem development and regulation
 → Control species gradient

→ Pollution control such as CO₂ by plant, Nitrogen fixation by Rhizobium

Diagram:



(v) Denitrification → bacteria convert nitrate back into nitrogen gas (N₂)

Ques. 1) food chain

→ QF shows a single, linear path of energy flow between organisms.

→ QF is affected, the whole chain is disturbed.

→ Ex: Grass → Deer → Tiger

→ QF is more stable as organisms have alternative food sources.
 → Ex: Grass → Deer → Fox.

(i) Grazing food chain: QF starts with grazing on killing.

Ex: Grass → Deer → Tiger

(ii) Detritus food chain: start with dead and decaying material.

Ex: Dead leaves → Earthworm → frog → snake

(iii) Parasitic food chain: parasite is taking food from living host.

Ex: Liver → Bird → Lice

Ques. 2) Biogeochemical Cycle:

The natural pathway through which essential elements like carbon, nitrogen, oxygen and water circulate between living organisms and the non-living environment.

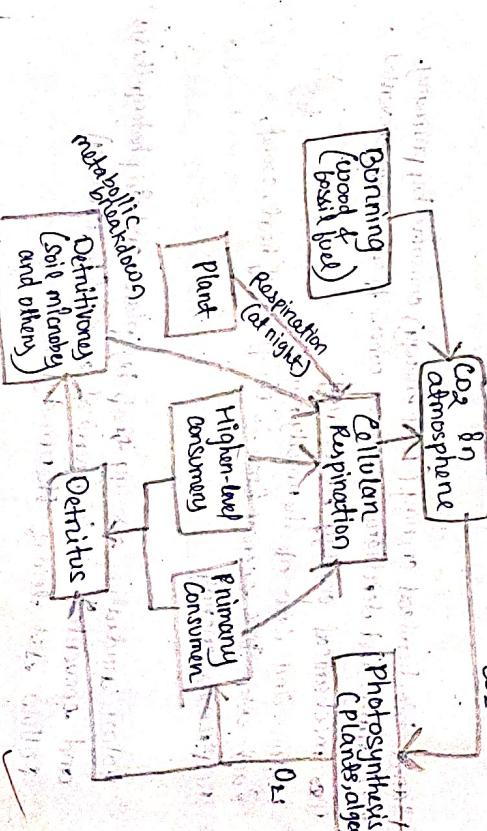
Nitrogen Cycle: The nitrogen cycle is the process by which nitrogen moves between the atmosphere, soil, plants, animals and microorganisms.

(i) Nitrogen fixation: bacteria convert atmospheric nitrogen (N₂) into usable forms.

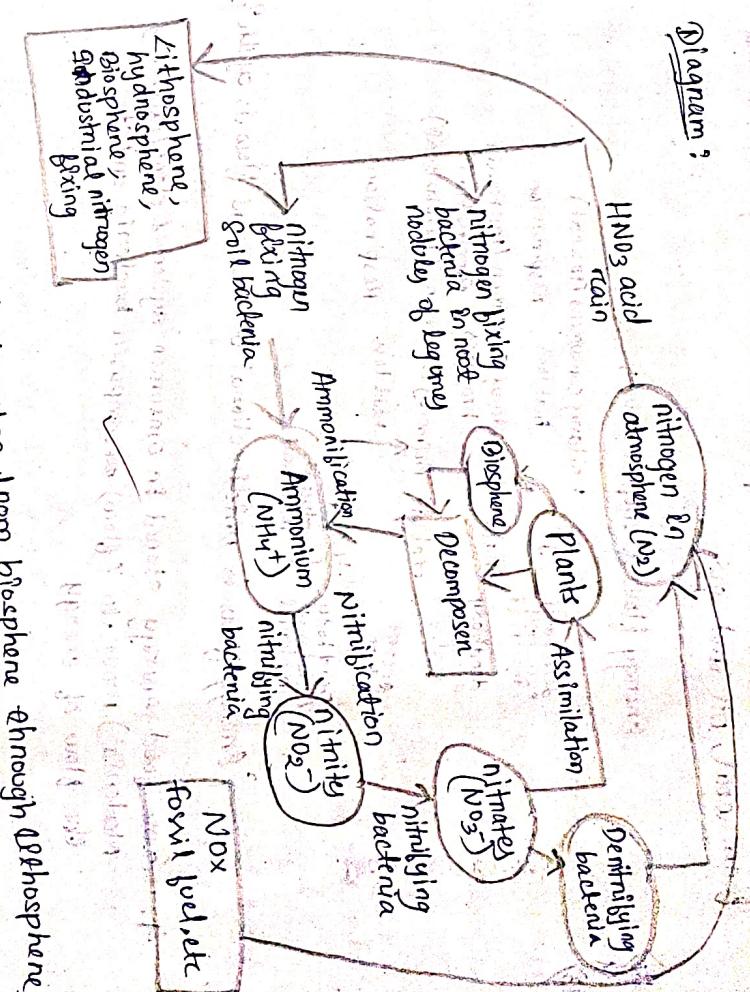
(ii) Nitrification → plants absorb nitrates to make protein.

(iii) Assimilation → plants absorb nitrates to make protein.

(iv) Ammonification → dead plants & animals decompose, releasing ammonia.

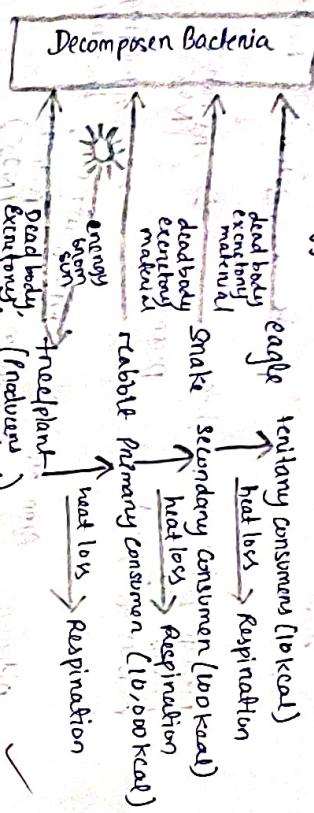


11) The cyclic movement of carbon from biosphere through hydrosphere and atmosphere called carbon cycle.



• Burning of fossil fuels and wood releases CO_2 into the atmosphere
• Own millions of years, dead plants and animals get buried and form coal, oil and gas

Energy flow & trophic levels



• Energy flow is unidirectional but nutrient flow is cycling

4. Some food energy stored in consumer system & plant (excactory material) move to (flow) decomposen bacteria and stop the flow of energy

• Energy flow is unidirectional but nutrient flow is cycling

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

2. Plants biochemical energy (food energy) consumed by primary, secondary and tertiary consumer where food energy converted to mechanical energy etc.

Follow up and Jroc ob the 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 up and Jroc ob the thermodynamic

13. Primary production is the process by which green plants, algae, and some bacteria produce organic matter (food) from carbon dioxide and water using sunlight through photosynthesis,

- * Gross primary production (GPP):
→ Total amount of energy on food produced by plants through photosynthesis
- Includes all the energy captured from sunlight

$$\rightarrow \text{formula} : GPP = NPP + \text{Respiration}$$

- * Net Primary Production (NPP):
→ Energy on food that remains after plants use some for respiration
→ Represents the energy available to herbivores & other consumers

$$\rightarrow \text{formula: } NPP = GPP - \text{Respiration}$$

- * "Pyramid of energy is always upright, while pyramid of number may be upright, inverted on both."

Pyramid of energy is always upright as it follows the 2nd law of thermodynamics which states that as energy is transferred or transformed, more and more of it is transferred to other forms. Energy flows in one direction from producer to consumer

Pyramid of number on the other hand can vary +

→ In a desert ecosystem, it is usually upright
(many grases → few herbivores → fewer carnivores)

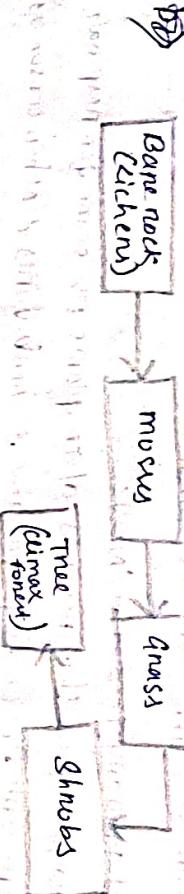
→ In a aquatic ecosystem, it can be inverted
(few plants → many animals → fewer fish),
because a small no. of producers have a high rate of reproduction and support many consumers

- 16. An orderly process of changes in the community structure and function!
with time mediated through modifications in the physical environment leading to the formation of a stable climax community over time

- (i) Nudation: A bare area is formed due to natural causes like volcanic eruption, landslide, drought or human activities
- (ii) Invasion: Seeds or spores of pioneer species reach the bare area by wind, water and on animals & plant growing
- (iii) Competition & co-action: As more species grow, they compete for space, light, water, nutrients, influencing each other
- (iv) Reaction: Growing organisms change the environment (like improving

(v) soil fertility, making it suitable for new species

(vi) Stabilization (climax): A stable and balanced community which develops, called the climax community, which remains in equilibrium with the environment.



17) Biomagnification is the gradual increase in the concentration of toxic substances as they move up the food chain. The poison enters at the lowest level and becomes more concentrated in the bodies of organisms at each higher trophic level.

water → algae → algae → insects → fish → humans

mercury concentration →
Big fish → humans

18) In-Situ conservation means conservation of species in its natural ecosystem or habitat through a network of "protected areas" and managed through legal effective means. These include Biosphere Reserve, National Parks, wildlife sanctuaries, etc.

19) Biodiversity means the variety of living organisms such as plants, animals, microorganisms, etc. found together in a particular area.

Type of biodiversity:-

(i) Species Biodiversity: Variety of species within a community in a particular region.

(ii) Genetic Biodiversity: Refers to the variation in genes within a species.

• about 1.8 million species are known on earth.
• Genetic recombination creates new varieties in plants & animals.

- helps species adapt to diseases and environmental changes.

(iii) Ecosystem Biodiversity: Refers to the variety of ecosystems formed by the interaction of biotic and abiotic components.

- shows differences in food chain,
- depends on factors like climate, soil, temperature, water

20) Values of biodiversity are—

(i) Direct Values (consumptive uses)

- food, fuel, medicines for local community — forest ecosystem produce as marketed and sold
- animal products like tusks of elephant, wool from sheep, etc.
- food: fish, other edible aquatic plants and animals — resources

(ii) Productive Value

- these are the commercially usable values where the product is marketed and sold
- animal products like tusks of elephant, wool from sheep, etc.
- raw material for industry like plywood industry, etc.
- agriculture like developing new crops/better crops with plant breeding

(iii) Social Values

- preserved as valuable resource many sacred and holy plants like cow
- based on religion worship: Quesi, Peepal and animals like cow

(iv) Ethical and moral values

- ethical responsibility to protect all life forms
- preservation of nature through local traditions
- Conservation of biodiversity & economic importance

(v) 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-tourism industry

(vi) Option Value

- keeping future possibilities open for their use is called the Option value.
- In nature many things yet to explore, plants, microorganism
- preservation of biodiversity must also include traditionally used strains already in existence in crops & domestic animals

21) "India is a mega biodiversity nation in the world"

- It has a wide range of climate & land is one of the 17 mega biodiversity countries in the world
- hosts about 7-8% of the world's recorded species including over 45000 plants and 41,000 animal species
- Its diverse habitats supports rich biodiversity and many endemic species found nowhere else

22) Endemic Species

- 22) Specie found only in a specific particular region and nowhere else in the world. Restricted to a specific geographic area
- National isolation, unique habitat
 - Habitat loss, pollution, hunting, Climate change, etc
 - Lion-tailed macaque (Western Ghats), Bengal tiger, Indian rhinoceros, Nilgiri Tahr, Asian elephant, Gaur, Indian gharial, Assam vulture, etc.
- 23) Major threats to biodiversity in India are—
- habitat loss and fragmentation
 - Pollution
 - overexploitation
 - Invasive species
 - Climate change
 - Illegal wildlife trade

24) Open biogeographic zone of India are—

- Trans-Himalayan zone
- Indian Plateau zone
- Ganggetic Plain zone
- North-East zone
- Semi-Arid zone
- western Ghats zone
- Coastal zone
- Islands zone

25) Areas which exhibit high species richness & high species endemism are termed as hot spots of biodiversity

The hotspot biodiversity of India are—

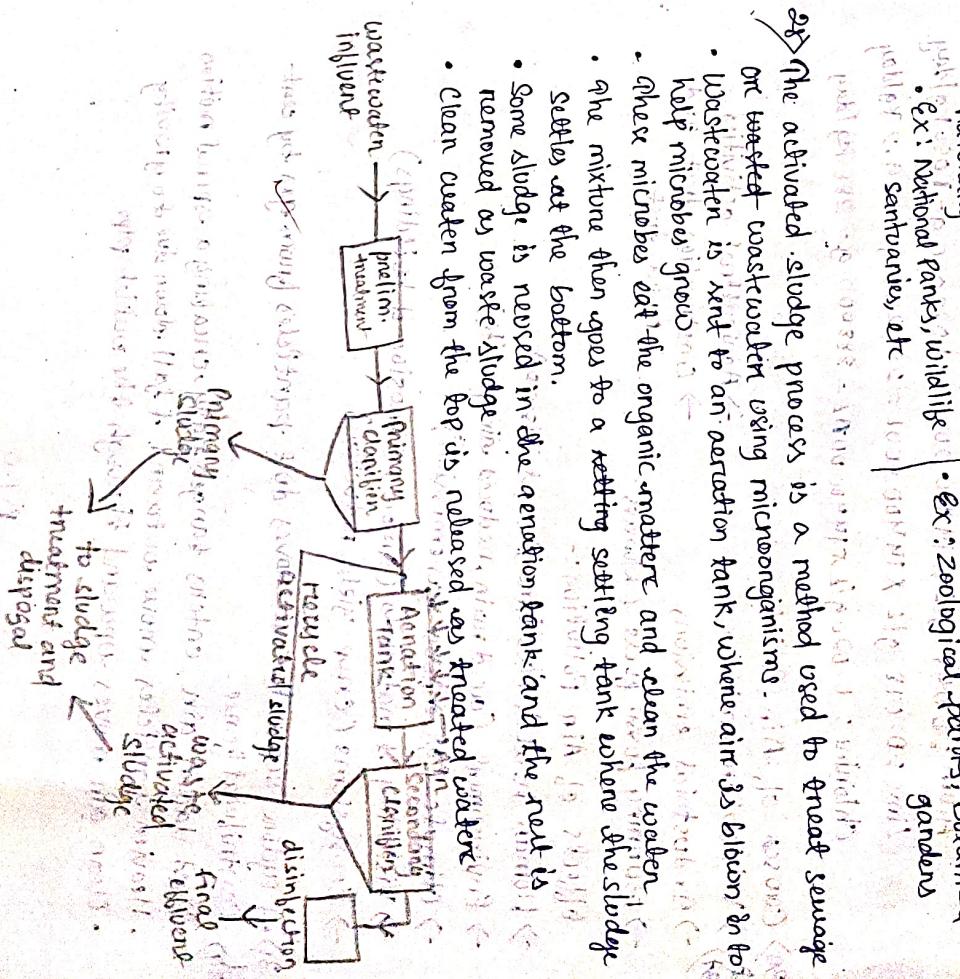
- Himalaya
- Indo-Burma
- Western Ghats
- Gondwana

In situ

- It means protecting & conserving biodiversity in their natural habitat, where its natural habitat, where species live and evolve naturally
- Ex: National parks, wildlife sanctuaries, etc.

Ex Situ

- It means protecting species outside their natural habitat by providing controlled conditions for their survival and breeding
- Ex: Zoological parks, Botanical gardens



29) WTP ($600 \text{ m}^3/\text{hr}$) given (Jarl West pen 1L)

alum soln : $5\text{ml of } 15\text{ g/L} \rightarrow \text{mass pen L}$

$$= 0.005 \times 15 = 0.075 \text{ g/L}$$

Lime solution : $3\text{ml of } 6\text{ g/L} \rightarrow \text{mass pen L}$

$$= 0.003 \times 6 = 0.018 \text{ g/L}$$

Chlorine soln : $4\text{ml of } 5\text{ g/L} \rightarrow \text{mass pen L}$

$$= 0.004 \times 5 = 0.020 \text{ g/L}$$

Plant flow : $600 \text{ m}^3/\text{hr} = 600,000 \text{ L/hr}$

$$\text{daily volume} = 600,000 \times 24 = 14,400,000 \text{ L/day}$$

daily chemical needs :

$$\text{Alum : } 0.018 \text{ g/L} \times 14,400,000 \text{ L} = 108,000 \text{ g} = 108 \text{ kg/day}$$

$$\text{Lime : } 0.005 \text{ g/L} \times 14,400,000 \text{ L} = 25920 \text{ g} = 259.2 \text{ kg/day}$$

$$\text{Chlorine : } 0.020 \text{ g/L} \times 14,400,000 \text{ L} = 288000 \text{ g} = 288 \text{ kg/day}$$

30) Causes of Air Pollution:

A) \rightarrow Vehicular emissions \rightarrow Agricultural activities

B) \rightarrow Industrial emissions \rightarrow Construction dust and

\rightarrow Burning fossil fuels & biomass.

C) \rightarrow Natural sources \rightarrow Road dust

D) Effects of Air Pollution:

\rightarrow Human health (asthma, heart disease)

\rightarrow Environment (acid rain, reduced visibility)

\rightarrow Climate (greenhouse gas emission)

\rightarrow Visibility & materials (smog, corrosion of buildings)

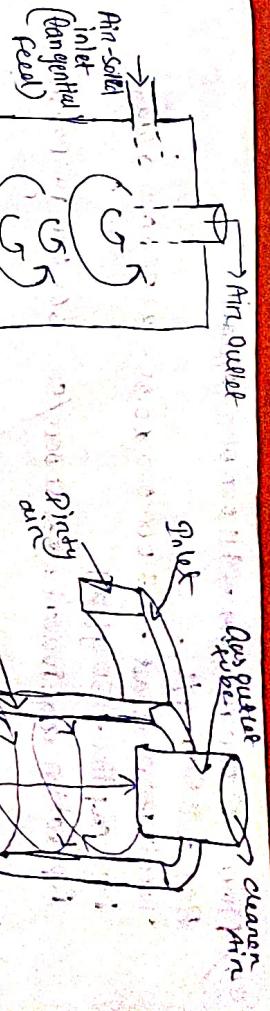
\rightarrow Ecosystems (crop yield reduction)

31) A cyclone separator removes dust particles from gas by centrifugal force.

Dust laden air enters tangentially, creating a spiral motion

Heavier particles move outward & fall down due to gravity

Clean air moves upward through the outlet pipe



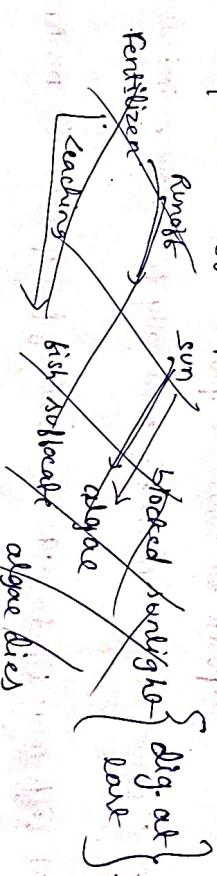
$$32) W = 0.15 \text{ m/s}, A = 1500 \text{ m}^2, Q = 2000 \text{ m}^3/\text{min} = 33.33 \text{ m}^2/\text{s}$$

$$n = 1 - e^{(-W/A)} = 1 - e^{(-0.15 \times 1500)} = 1 - e^{(-6.75)} \approx 99.9\%.$$

33) Eutrophication is the excessive growth of algae in water bodies due to nutrient enrichment.

Causes: Agricultural runoffs, sewage detergents

Consequences: Oxygen depletion, fish death, bad odor



34) (1) Primary Treatment: Screening, grit removal, primary sedimentation.

(2) Secondary Treatment: Biological oxidation (activated sludge, trickling filter)

(3) Tertiary Treatment: Filtration, chlorination, nutrient removal

4) Sequential boxes showing Influent \rightarrow Primary \rightarrow Secondary \rightarrow Tertiary \rightarrow Effluent

Q12.

Date: 14/10/25

a) Write down modern agriculture and impact on food security

Ans) The use of high-yield variety seeds, fertilizers, pesticides, irrigation and machinery

• Positive Impact: Increased food production, improved productivity and reduced famine

• Negative Impact: Soil degradation, water pollution, loss of biodiversity and dependence on chemicals

Q2) Highlight the cause of Blue Baby syndrome.

- Ans) Caused by high nitrate levels in drinking water
- Nitrates convert NO nitrites in the body → reduce oxygen carrying capacity of blood (methemoglobin)
- Common in infants consuming formula, mixed with contaminated water.

Q3) Define undernourishment, malnourishment and hunger hotspot

Ans) • Insufficient intake of calories and nutrients to meet the body's basic energy requirements is called undernourishment.

• Imbalance in nutrient intake, either deficiency or excess of vitamins, minerals or often nutrients is called malnourishment.

• Geographical area where severe food insecurity and under-nutrition are prevalent, often due to conflict, poverty or climate change, is called hunger hotspot.

Q4) Highlight the importance of greenhouse depletion of ozone layer, impact of global warming and mitigation strategies for it.

Ans) Green house gases include CO₂, CH₄, NO_x and water vapour

They trap infrared radiation and keep the earth warm.

Importance:

- maintain earth's temperature suitable for life
- enable photosynthesis & water cycle regulation

Ozone layer depletion: caused by chlorofluorocarbons and halons that destroys ozone molecules, allowing harmful UV radiations to reach earth.

Impact of global warming:

- melting of glaciations and rise in sea levels
- extreme weather pattern
- loss of biodiversity & agricultural productivity
- use of renewable energy (solar, wind, etc.)
- reforestation & afforestation
- Energy efficiency & sustainable management
- phasing out CFCs and industrial emissions

Q5) Briefly describe different types of ultraviolet radiation and its toxic effects on humans. Why Montreal protocol was adopted? Write details about ozone holes and

ozone measurement.

Ans) Types of UV radiations:-

• UVA (315-400nm): Least energetic, causes skin aging & DNA damage!

• UVB (280-315nm): More energetic, mostly absorbed by ozone layer.

• UVC (200-280nm): most energetic, causes non-bonous, cataracts

Toxic effects on humans:-

- DNA mutations & skin cancer
- Eye cataracts & retinal damage
- Immune system suppression
- premature skin aging
- Deafness

Montreal Protocol (1987): Adopted to phase out ozone-depleting substances such as CFCs, halons and carbon tetrachloride to protect the ozone layer

Ozone hole:

Major depletion observed over Antarctica & Arctic regions

• caused by photochemical reactions involving species
releasing chlorine and bromine radicals.

• measurement: Done in Dobson Units $\hat{=} 1 \text{ DU} = 0.01 \text{ mm}$

- normal level $\approx 300 \text{ DU}$

Q6) Define formation of acid rain, its causes, impact & control measures

A) Formation: • Caused by emissions of SO_2 and NO_x from vehicle industries, power plants

- These gases react with atmospheric water to form H_2SO_4 & HNO_3 which falls as acid rain

Impacts:

- Acidification of lakes & soil
- Damage to crops, buildings, etc.
- Harm to aquatic life
- Use of non-renewable fuels
- Installation of scrubber & catalytic converters
- Shifting to renewable energy

Q7) What are the types of solid waste? Address their sources, uses & effects

A) Municipal: Household, commercial waste

Industrial: Chemical, toxic residues, oil & gas.

Biosocial: Hospital waste (syringes)

Electronic: Electronic device

- Agricultural: Crop residues, animal dung
- Effects: Pollution, disease, soil & water contamination

Q8) Write short notes on mechanism of solid waste management.

Ans) Waste generation, collection, treatment, disposal

• waste generation

- Collection & segregation
- Disposal

• Management

Goal: Reduce, reuse, recycle

Q9) Impact of noise pollution on health & how to control noise

Ans) Health Effect: Stress, hearing loss, sleep disturbance, hypertension

Control measures: Sound proofing, green belts, proper zoning, noise regulation, awareness

Q10) What are the effects of deforestation? Highlight role

Ans) Erosion & drought

- Loss of biodiversity & wildlife habitat
- Increased CO_2 leading to global warming
- Soil erosion: Removal of top fertile soil due to loss of vegetation cover
- Drought: Reduced rainfall, disturbed water cycle, loss of soil moisture

Very Nice
Approved By
Dr. Dr. Tapasita Bhattacharya
Date: 11.12.20