CHAPTER

16 ENVIRONMENTAL ISSUES

Syllabus

➢ ***Environmental issues :*** *Air pollution and its control; water pollution and its control; agro chemicals and their effects; solid waste management; radioactive waste management; green house effect and global warming; ozone depletion; deforestation; any three case studies as success stories addressing environmental issues.*

Chapter Analysis

List of Topics		2016		2017		2018
		D	OD	D	OD	D/OD
Air pollution	• Cause, effect and control method of air pollution • Electrostatic precipitator • Advantages of CNG over diesel	1 Q (3 M)	1 Q (1 M)	1 Q (3 M)	1 Q (1 M)	1 Q (3 M)
Water pollution	• Integrated waste water treatment					1 Q (2 M)
Agro chemicals and their effects	• Biological oxygen demand • Algal bloom and its effect	1 Q (1 M)		1 Q (2 M)		1 Q (3 M)
Ozone depletion	• Chlorofluorocarbon (CFCs) • Relationship between CFCs and ozone		1 Q (2 M)		1 Q (2 M)	

- *From the above analysis, it can concluded that important topics from this chapter from exam point of view are air pollution (its causes, effect and control measures), electrostatic precipitator, concept of integrated waste water treatment, significance of BOD, Algal bloom and its effect on aquatic organisms, and concept of ozone depletion (relationship between CFCs and ozone).*

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TOPIC-1
Pollution, Solid and Radioactive Wastes

Revision Notes

➢ **Introduction**

- Human population explosion increases the demand for food, water, home, electricity, roads, automobiles, etc.
- It leads to pollution of air, water and soil and depletion of valuable natural resources.
- Pollution is any undesirable change in physical, chemical or biological characteristics of air, land, water or soil.
- Agents that cause pollution are called pollutants.

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- The Government of India has passed the **Environment (Protection) Act, 1986** to control environmental pollution and protect and improve the quality of our environment.

Air Pollution and Its Control

➢ **Causes of Air Pollution**
- Particulate and gaseous air pollutants from smoke stacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants.
- According to Central Pollution Control Board (CPCB), particulate size of less than 2.5 mm in diameter (PM 2.5) causes greatest harm to human health.
- Pollutants from automobiles.
- Use of leaded petrol.

➢ **Harmful Effects of Air Pollution**
- Air pollutants cause injury to all living organisms.
- They reduce growth and yield of crops and cause premature death of plants.
- Air pollutants affect the animals and humans respiratory system.
- It causes respiratory problems, irritation, inflammations and damage to lungs and premature deaths.

➢ **Control of Air Pollution**

(a) Particulate matters must be separated/filtered out before releasing the harmless gases into the atmosphere.

(b) Use of catalytic converters (having Platinum-Palladium & Rhodium as the catalysts).
- It reduces emission of poisonous gases.
- This converts unburnt hydrocarbons to CO_2 and water, and carbon monoxide and nitric oxide to CO_2 and nitrogen gas, respectively.
- Motor vehicles having catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalyst.

(c) Proper maintenance of automobiles along with use of lead-free petrol or diesel can reduce the pollutants they emit.

(d) Catalytic converters, having expensive metals namely platinum-palladium and rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases.

(e) Phasing out of old vehicles

(f) Use of low-sulphur and aromatic content in petrol and diesel

(g) Application of pollution-level norms for vehicles, etc.

➢ **Controlling Vehicular Air Pollution : A Case Study of Delhi**
- In Delhi, **compressed natural gas (CNG)** in public transport (buses) is used.
- **CNG is better than petrol and diesel because—**

(a) CNG burns most efficiently and very little of it is left unburnt.

(b) CNG is cheaper than petrol or diesel, cannot be siphoned off by thieves and adulterated like petrol or diesel.
- **The main problem with CNG is-**

(a) The difficulty of laying down pipelines to deliver

(b) Distribution points/pumps and ensuring uninterrupted supply.

➢ **Electrostatic Precipitator**
- It is the electrical device widely used to remove particulate matter present in the exhaust of thermal power plants and vehicular exhaust.
- It can remove over 99% particulate matter present in the exhaust from a thermal power plant.
- The electrons released from electrode wires (maintained at several thousand volts) attach to dust particles and give a negative charge.
- The collecting plates are earthed so that they attract the charged dust particles.
- The velocity of air between the plates must be low enough to allow the dust to fall.
- A scrubber removes gases like SO_2.
- In a scrubber, the exhaust is passed through a spray of water or lime.
- Very small particulates are not removed by this precipitator.

Laws & policies in India to control vehicular pollution

(a) Auto fuel policy
- It has laid out a roadmap to cut down vehicular pollution in Indian cities. It has steadily reduced the sulphur and aromatic content in petrol and diesel fuels.

(b) Euro II norms
- It stipulates that sulphur should be at 350 parts-per-million (ppm) in diesel and 150 ppm in petrol.
- Aromatic hydrocarbons are to be contained at 42%of the concerned fuel.

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- The goal is to reduce sulphur to 50 ppm in petrol and diesel and bring down the level to 35%.
- Vehicle engines will also need to be upgraded.

(c) The Bharat Stage II

- All automobiles and fuel have to meet the Euro III emission specifications in 11 cities from 1 April 2005 and had to meet the Euro-IV norms by 1 April 2010.
- The rest of the country have Euro-III emission norm compliant automobiles and fuels by 2010.

Noise Pollution

- In India, the Air (Prevention & Control of Pollution) Act (1981) was amended in 1987 to include noise as an air pollutant.
- Noise is undesired high level of sound.

➢ **Sources of Noise Pollution**

- Music instruments, loudspeaker, crackers, industries, etc.

➢ **Harmful Effects of Noise**

- Noise causes psychological and physiological disorders.
- The sound level above 150 dB (generated by take off of a jet plane or rocket) may damage ear drums.
- Chronic exposure to relatively lower noise may damage hearing abilities of humans.
- It causes sleeplessness, increased heartbeat and hypertension and breathing problem, stress, etc.

➢ **Control of Noise Pollution**

- Use of sound absorbent materials in industries.
- Delimitation of horn-free zones around hospitals and schools.
- Permissible sound-levels of crackers and loudspeakers.
- Delimit the timings of using loudspeakers.

Water Pollution and Its Control

- Water bodies are lifeline of all living organisms.
- Due to human activities, the ponds, lakes, streams, rivers, estuaries and oceans are becoming polluted.
- The Government of India has passed the Water (Prevention and Control of Pollution) Act, 1974 to safeguard our water resources.

➢ **Domestic Sewage and Industrial Effluents**

- A mere 0.1 % impurities make domestic sewage unfit for human use.
- The composition of waste water contains suspended solids (sand, silt, clay etc), colloidal materials (faecal matter, bacteria, cloth, paper, fibres etc.) and dissolved materials (nutrients like nitrate, NH_3, phosphate, Na, Ca etc).
- Solids are easy to remove.
- Removal of dissolved materials, organic compounds and toxic metal ions are most difficult.
- Domestic sewage mainly contains biodegradable organic matter.
- It is decomposed by microorganisms, which can multiply using these organic substances as substrates and hence utilize some of the components of sewage.
- Sewage from homes and hospitals may contain undesirable pathogens and its disposal into water causes serious diseases like dysentery, typhoid, jaundice, cholera, etc.
- Industrial (petroleum, metal, paper manufacturing, chemical manufacturing, etc.) waste water contains toxic substances like heavy metals such as mercury, cadmium, copper, lead, etc. and organic compounds.
- Some toxic substances (mercury, DDT etc) present in industrial waste water, cause biological magnification (biomagnification) in the aquatic food chain.

➢ **Biochemical Oxygen Demand - BOD**

- The amount of biodegradable organic matter in sewage water is estimated by measuring Biochemical Oxygen Demand (BOD).
- During biodegradation, microorganisms consume a lot of O_2.
- It results in a sharp decline in dissolved O_2. This causes death of aquatic organisms.

➢ **Algal Bloom**

- Presence of large amounts of nutrients in water also causes excessive growth of planktonic algae (algal bloom).
- It imparts a distinct colour to the water bodies and deteriorates the water quality resulting in death of fishes.
- Some bloom-forming algae are extremely toxic to human beings and animals.
- The water hyacinth (*Eichhornia crassipes*) is the most problematic aquatic weed (Terror of Bengal').
- They grow faster than our ability to remove them.
- They grow abundantly in eutrophic water bodies.
- It leads to an imbalance in the ecosystem dynamics of the water body.

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- **Biomagnification**
  - Biomagnification is the accumulation of the toxicant at successive trophic levels.
  - The organism in each trophic level cannot metabolize or excrete the toxicant (like mercury, calcium and DDT), and is thus passed on to the next trophic level.
- **Biomagnification of DDT (dichlorodiphenyl trichloroethane) in an Aquatic Food Chain**
  - Water (DDT : 0.003 ppm) → zooplankton (0.04 ppm) → small fish (0.5 ppm) → large fish (2 ppm) → birds (25 ppm).
  - DDT disturbs calcium metabolism in birds, which causes thinning of egg shell and their premature breaking.
  - It causes decline in bird populations.
- **Eutrophication**
  - It is the natural ageing of a lake by nutrient enrichment of water.
  - In a young lake the water is cold and clear.
  - With time, streams draining into the lake introduce nutrients like N_2, P, etc, which encourage the growth of aquatic organisms.
  - As the lake's fertility increases, plants and animals grow rapidly, and organic remains are deposited on the lake bottom.
  - Thus, the lake grows shallower and warmer, with warm-water organisms.
  - Marsh plants take root in the shallows and fill in the original lake basin.
  - Eventually, the lake becomes a bog, finally converting into land.
  - Depending on climate, size of the lake and other factors, the eutrophication may span thousands of years.
  - However, pollutants like effluents from the industries and homes accelerate the ageing process. This phenomenon is called **Cultural** or **Accelerated Eutrophication**.
  - The prime contaminants are nitrates and phosphates, which act as plant nutrients.
  - They over stimulate the growth of algae, causing unsightly scum and unpleasant odours, and robbing the water of dissolved oxygen vital to other aquatic life.
  - At the same time, other pollutants flowing into a lake may poison whole populations of fish; whose decomposed remains further deplete the water's dissolved oxygen content.
- **Thermal Waste Water**
  - Heated (thermal) wastewater from electricity-generating units (*e.g.,* thermal power plants) eliminates organisms sensitive to high temperature.
  - It may enhance the growth of plants and fish in extremely cold areas but, only after causing damage to the indigenous flora and fauna.
- **A Case Study of Integrated Waste Water Treatment**
  - Wastewater along with sewage are treated by artificial and natural processes.
  - An example is the town of Arcata, situated along the northern coast of California.
  - Collaborating with biologists from the Humboldt State University, the town people created an integrated waste water treatment process within a natural system.
  - **The cleaning occurs in two stages :**
    - **(a)** Sedimentation, filtering and chlorine treatments.
      - After this stage, lots of dangerous pollutants like dissolved heavy metals still remain.
      - To combat this, an innovative approach was taken.
    - **(b)** The biologists developed a series of six connected marshes over 60 hectares of marshland.
      - Appropriate plants, algae, fungi and bacteria were seeded into this area, which neutralize, absorb and assimilate the pollutants.
      - Hence, as the water flows through the marshes, it gets purified naturally.
      - The marshes also constitute a sanctuary, with a high level of biodiversity in the form of fishes, animals and birds that now reside there.
      - A citizens group called **Friends of the Arcata Marsh** (FOAM) is responsible for the upkeep and safeguarding of this wonderful project.
- **Ecological Sanitation**
  - It is a sustainable system for handling human excreta, using dry composting toilets.
  - This is a practical, hygienic, efficient and cost-effective solution to human waste disposal.
  - Most importantly with this composting method, human excreta can be recycled into a resource (as natural fertiliser), which reduces the need for chemical fertilisers.
  - There are 'EcoSan' toilets in many areas of Kerala and Sri Lanka.
- **Solid Wastes**
  - Solid wastes refer to everything that goes out in trash.
  - These are discarded solid materials which are produced due to various human activities.

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- Municipal solid wastes are wastes from homes, offices, stores, schools, hospitals, etc., that are collected and disposed by the municipality.
- The municipal solid wastes include paper, food wastes, plastics, glass, metals, rubber, leather, textile, etc.
- Burning reduces the volume of the wastes, although it is generally not burnt to completion and open dumps often serve as the breeding ground for rats and flies.

➢ **Sanitary Landfills**
- These were adopted as the substitute for open-burning dumps.
- In a sanitary landfill, wastes are dumped in a depression or trench after compaction, and covered with dirt every day.
- Landfills are also not really much of a solution since the amount of garbage generation especially in the metros has increased so much that these sites are getting filled too.
- Also there is danger of seepage of chemicals, etc., from these landfills polluting the underground water resources.

➢ **Types of Solid Wastes**
- All wastes can be categorized into three types namely :
  (a) Bio-degradable
  (b) Recyclable
  (c) Non-biodegradable

➢ **Plastic Wastes**
- It is important that all garbage generated is sorted in order to recycle or reuse.
- Kabadiwallahs and rag-pickers help to separate materials for recycling.
- The biodegradable materials can be put into deep pits in the ground and be left for natural breakdown.
- This leaves only the non-biodegradable to be disposed off.
- We are increasing the use of non-biodegradable products. *e.g.,* plastic packets of eatables such as biscuit packet, milk and water in polybags, packed fruits and vegetables (in polystyrene and plastic packaging) etc.
- State Governments are trying to push for reduction in use of plastics and encouraging use of eco-friendly packaging.
- We can use carrying cloth or other natural fibre carry-bags instead of polythene bags for shopping.

➢ **Hospital Wastes**
- Hospital wastes contain disinfectants and other harmful chemicals, and also pathogenic micro-organisms.
- The incinerators are used to dispose hospital wastes.

➢ **E-wastes**
- Irreparable computers and other electronic goods are known as **electronic wastes (e-wastes)**.
- They are buried in landfills or incinerated.
- Over half of the e-wastes generated in the developed world are exported to developing countries, mainly to China, India and Pakistan, where metals like copper, iron, silicon, nickel and gold are recovered during recycling process.
- Developed countries have specifically built facilities for recycling of e-wastes.
- Recycling in developing countries often involves manual participation thus exposing workers to toxic substances present in e-wastes.
- Recycling is the only solution for the treatment of e-waste, provided it is carried out in an environment friendly manner.

➢ **Case Study of Remedy for Plastic Waste : Polyblend**
- **Ahmed Khan,** a plastic sack manufacturer in Bangalore developed Polyblend.
- It is a fine powder of recycled modified plastic.
- Polyblend is mixed with the bitumen and is used to lay roads.
- Blend of Polyblend and bitumen enhances the bitumen's water repellant properties and helps to increase road life.

➢ **Agro-Chemicals and Their Effects**
- In the wake of green revolution, use of inorganic fertilisers, pesticides, herbicides, fungicides, etc. has increased manifold for enhancing crop production.
- These are toxic to non-target organisms that are important components of the soil ecosystem.
- These can be biomagnified in the terrestrial ecosystems.
- Chemical fertilisers cause eutrophication.

➢ **Case Study of Integrated Organic Farming**
- Integrated organic farming is a cyclical, zero-waste procedure, where waste products from one process are cycled in as nutrients for other processes.

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- This allows the maximum utilization of resource and increases the efficiency of production.
- Ramesh Chandra Dagar, a farmer in Sonipat, Haryana included bee-keeping, dairy management, water harvesting, composting and agriculture in a chain of processes, which support each other and allow an extremely economical and sustainable venture.
- There is no need of chemical fertilisers, as cattle excreta (dung) are used as manure.
- Crop waste is used to create compost, which can be used as a natural fertilizer or can be used to generate natural gas for satisfying the energy needs of the farm.
- Dagar has created the Haryana Kisan Welfare Club, with a membership of 5000 farmers to spread information on the practice of integrated organic farming.

➢ **Radioactive Wastes**

- Radiation from nuclear waste has an adverse effect on living organisms, because it causes mutations at a very high rate.
- At high doses, nuclear radiation is lethal but at lower doses, it creates various disorders, such as cancer.
- It has been recommended that storage of nuclear waste, after sufficient pre-treatment, should be done in suitably shielded containers buried within the rocks, about 500 m deep below the earth's surface.
- However, this method of disposal is meeting stiff opposition from the public.
- Use of nuclear energy has two very serious problems:
  (a) Accidental leakage. *e.g.,* incident in the Three Mile Island and Chernobyl incidents
  (b) Safe disposal of radioactive wastes.

Very Short Answer Type Questions (1 mark each)

Q. 1. Mention two advantages for preferring CNG over diesel as an automobile fuel.

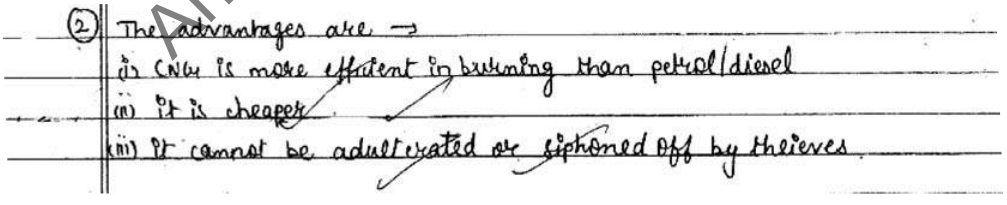
U **[Outside Delhi Set-I, 2016]**

Ans. Advantages of CNG :
(i) Burns efficiently/less unburnt residues.
(ii) Cheaper than petrol/diesel.
(iii) Causes less pollution.
(iv) Cannot be adulterated.
(v) Cannot be siphoned by thieves. **1**

(Any two) [CBSE Marking Scheme, 2016]

OR

Ans.



[Topper's Answer, 2017]

Commonly Made Error

- Students sometimes write more than two points. Be specific. Read question carefully and write only what is asked.

Q. 2. Excessive nutrients in a fresh water body cause fish mortality. Give two reasons.

U **[Delhi Set-I, 2016]**

Ans. Excessive nutrients in a freshwater body cause fish mortality due to the following reasons :
(i) Depletion of dissolved oxygen.
(ii) Increase in toxic material in water body. ½+½

[CBSE Marking Scheme, 2016]

Q. 3. List two advantages of the use of unleaded petrol in automobiles as fuel.

R **[Outside Delhi Set-I, 2015]**

Ans. The advantages are as follows :
(i) Unleaded petrol does not release lead compounds from exhaust fumes into the atmosphere and causes less pollution.
(ii) It does not emit harmful compounds, it helps in preventing health diseases like bronchitis, asthma and lung diseases.

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(iii) It allows catalytic converter to remain active.

½+½

(Any two) [CBSE Marking Scheme, 2015]

Q. 4. Write the name of organism which is referred to as ''Terror of Bengal''.

R **[Delhi Set-I, 2014]**

Ans. Water hyacinth (*Eichhornia crassipes*). **1**

Q. 5. Inspite of being non-polluting why are there great apprehensions in using nuclear energy for generating electricity ?

U **[Delhi Set-II, III, 2014]**

Ans. Accidental leakages, safe disposal of radioactive waste. **1**

[CBSE Marking Scheme, 2014]

Q. 6. List two gaseous products that are produced when exhaust of an automobile passes through a catalytic converter. R **[Delhi Set-I, Comptt., 2012]**

Ans. Carbon monoxide and nitric oxide. (When an automobiles exhaust passes through catalytic converter, it converts nitric oxide into nitrogen and oxygen and carbon monoxide to CO_2 and unburnt hydrocarbons get completely burnt into CO_2 and H_2O.) **1**

Q. 7. An electrostatic precipitator in a thermal power plant is not able to generate high voltage of several thousands. Write ecological implication because of it. A **[Outside Delhi - 2017, Set - I]**

Ans. Air Pollution //
Particulate matter //dust particles released in the air. **1**

[CBSE Marking Scheme, 2017]

OR

Ans.

Q. The high voltage wires in electrostatic precipitators produces a corona of electrons, which attach to dust particles, make them negatively charged and attracted by grounded by collection plates. In this way the exhaust is purified. The inability to generate thousands of volt fails to remove the particulate matters present in the exhaust and causes air pollution. This may affect both plant and animal life deleteriously by causing respiratory problems.

[Topper's Answer, 2017]

Q. 8. Why should motor vehicles equipped with catalytic convertors use unleaded petrol ? A **[Delhi Comptt. 2012]**

OR

Why is it desirable to use unleaded petrol in vehicles fitted with catalytic converters ?

[Outside Delhi Set-I, 2011]

Ans. Lead in petrol inactivates the catalysts and harmful pollutants (CO, unburnt hydrocarbons, nitric oxide) are converted to lesser harmful pollutants (CO_2, H_2O, N_2) **1**

[CBSE Marking Scheme, 2012]

Commonly Made Error

- Many students fail to write the correct explanation. They are unable to write the names of the harmful pollutants and their conversion names.

Q. 9. State the cause of Accelerated Eutrophication.

R **[Delhi Set-I, II, 2014, Delhi Set-II, 2011]**

Ans. Pollutants from human activities / effluents from industries / effluents from home / sewage / agricultural (chemical) wastes radically accelerate the ageing process. **1**

[CBSE Marking Scheme, 2014]

Q. 10. How do algal blooms affect the life in water bodies ?

R **[Outside Delhi Set-I, II, III, 2011]**

Ans. Algal bloom causes deterioration of the water quality and aquatic life mortality. **1**

[CBSE Marking Scheme, 2011]

Answering Tip

- Discuss thoroughly the concept of algal bloom and water pollution. While explaining, also stress on significance of BOD in aquatic ecosystem.

AI **Q. 11. BOD of two samples of water A & B were 120 mg/l and 400 mg/L respectively. Which sample is more polluted ?**

E & A **[Foreign Set, 2009]**

Ans. Sample B is more polluted than Sample A. **1**

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Short Answer Type Questions-I (2 marks each)

Q. 1. Lower BOD of a water body helps reappearance of clean-water organisms. Explain.

U **[Foreign Set-I, 2016]**

Ans. Lowering of Biological Oxygen Demand (BOD) results in decreased biodegradable material in the water body → As result of which there is reduced microbial decomposition → when there is no decomposition, oxygen utilisation is reduced → More Dissolved Oxygen (DO) is available → clean water-organisms reappear. ½ × 4 = 2

[CBSE Marking Scheme, 2016]

Answering Tips

- Discuss thoroughly, the significance of BOD in an aquatic ecosystem.
- Also connect water pollution to algal bloom.
- Advise students to carefully read and understand the requirement of the question before answering it.

Q. 2. How e-wastes are being handled in our country? Write the correct solution for treating this waste.

A **[Foreign Set-II, 2016]**

Ans. E-wastes are being buried in landfills, or incinerated (manually). Recycling this waste in the environment friendly manner is the right solution. 1 × 1 = 2

[CBSE Marking Scheme, 2016]

AI **Q. 3. Name any two sources of e-wastes and write two different ways for their disposal.**

U **[Delhi Set-I, 2013]**

Ans. Two sources of e-wastes are : televisions and computers.

They can be disposed by :

(i) Land filling : Soil is excavated from the trenches and waste material is buried in it, which is covered by a thick layer of soil.

(ii) Recycling : Recycling is the practice of reusing items that would otherwise be discarded as waste. 1 + 1

Q. 4. How did Ahmed Khan, plastic sacks manufacturer from Bangalore, solve the ever-increasing problem of accumulating plastic waste ?

A **[Outside Delhi Set-II, 2012]**

Ans. Collected plastic wastes-recycled-powdered-to form polyblend, blended with bitumen, used in road laying, increased road life by a factor of three / more durable. 2

[CBSE Marking Scheme, 2012]

Detailed Answer :

He collected plastic wastes and recycled them. He powdered plastic to form polyblend, which is blended with bitumen. Polyblend was used in road laying, which increased road life by a factor of three, making it more durable.

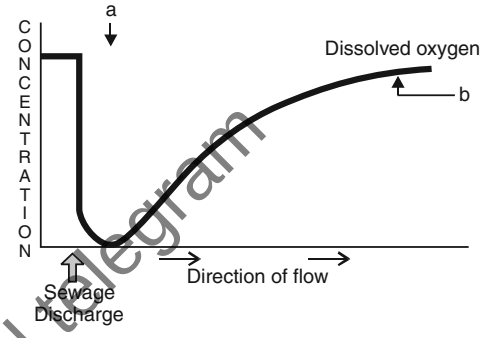
Q. 5. Study the graph given below. Explain how is oxygen concentration affected in the river when sewage is discharged into it.

E & A **[Delhi Set-I, II, III, 2011]**

OR

Explain giving reasons the cause of appearance of peaks 'a' and 'b' in the graph shown below.

[Outside Delhi Set-I, II, III, 2010]



Ans. Figure indicates effect of sewage discharge on river water.

(i) (a) Represents high BOD due to sewage discharge complete.

(ii) (b) Represent increase in dissolved oxygen to sewage decomposition.

When sewage is discharged into river, microorganisms present in water helps in biodegradation of organic matter. They consume lot of oxygen. Therefore, there is sharp decline in dissolved oxygen. When the sewage is completely degraded, oxygen concentration again increases. 2

Commonly Made Error

- Students write vague answers. It seems they are unable to understand the graph.

Answering Tip

- Practice understanding the graph to answer the questions.

AI **Q. 6. What is polyblend ? Why did the plastic manufacturers think of producing it ? Write its usefulness.**

A **[Delhi Comptt. 2011]**

Ans. Polyblend : It is a fine powder of recycled modified plastic developed by a Bangalore-based company. This mixture is mixed with the bitumen that is used to lay roads.

The plastic sack manufacturer in Bangalore has managed to find the ideal solution to the ever-increasing problem of accumulating plastic waste. Polyblend and bitumen, when used to lay roads, enhanced the bitumen—water repellant properties and helped to increase the road life by a factor of three. 2

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Q. 7. How do automobiles fitted with catalytic converters reduce air pollution? Suggest the best fuel for such vehicles.

[CBSE SQP, 2019]

OR

State the function of a catalytic converter in an automobile. [Outside Delhi Comptt. 2011]

R **[Outside Delhi Comptt. 2011]**

Ans. **(a)** Catalytic converters have expensive metals like platinum–palladium and rhodium as catalysts. ½

(b) As the exhaust emission passes through the catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water. ½

(c) Carbon monoxide and nitric oxides are changed to carbon dioxide and nitrogen gas respectively. ½

(d) Unleaded petrol is the best fuel. ½

[CBSE Marking Scheme, 2018]

Q. 8. Mention how e-waste is produced and disposed off. Write the solution for its treatment.

U **[Outside Delhi Set-I, II, III, 2011]**

Ans. Irreparable computers and other electronic goods are known as electronic wastes (e-wastes). E-wastes are buried in landfills or incinerated. The e-wastes generated in the developed world are exported to developing countries, mainly to China, India, and Pakistan, where metals like copper, iron, silicon, nickel and gold are recovered during the recycling process. Unlike developed countries, recycling of e-wastes in developing countries often, involves manual participation, thus exposing workers to toxic substances present in e-wastes.

Recycling is the only solution for the treatment of e-waste, provided it is carried out in an environment friendly way. **2**

Q. 9. Mention the major causes of air pollution in metro cities. Write any three ways by which it can be reduced.

C **[Outside Delhi Set-I, II, III, 2011]**

Ans. **The major causes of air pollution in metro cities are :**

(i) Smokestacks of thermal power plants, smelters and other industries.

(ii) Burning fossil fuels in automobiles, industries and households.

(iii) Smoke from forest fires, volcanic eruptions.

(iv) Decomposition of garbage, resulting in release of unwanted gases into the atmosphere.

Three ways to reduce the air pollution are as follows :

(a) Electrostatic precipitator.

(b) Scrubber.

(c) Catalytic converter **2**

Commonly Made Error

- Many students write the same points in different words.

Answering Tip

- Learn the causes and effects of pollution under separate heads.

Q. 10. Explain accelerated eutrophication. Mention any two consequences of this phenomenon.

R **[Delhi Set-I, II, III, 2011]**

Ans. Accelerated eutrophication occurs due to the passage of sewage and run-off from fertilized fields into ponds, lakes and other water bodies. Nutrients present in sewage and fertilizers causes dense growth of plants and planktonic algae.

Consequences of accelerated eutrophication :

(i) Eutrophic water bodies support excessive growth of floating plants, *e.g.*, water hyacinth is one such plant that sometimes chokes ponds, lakes and rivers.

(ii) Due to increase of algal blooms, there is drastic decrease in oxygen replenishment inside water that kills aquatic animals. **2**

Q. 11. Plenty of algal bloom is observed in a pond in your locality.

(i) Write what has caused this bloom and how it affect the quality of water.

(ii) Suggest a preventive measure.

U **[Delhi - 2017, Set - I, II, III]**

Ans. **(i)** Presence of large amounts of nutrients / nitrogen / phosphorus in water causes excessive growth of algae, depletes dissolved oxygen / imparts a distinct colour to the water bodies / bloom forming algae are extremely toxic / deteriorates water quality / fish mortality ½ + ½

(ii) Treatment of waste water before it reaches the pond / Integrated waste water treatment / avoiding using NPK fertilizers / use of organic or biodegradable manure / resort to organic farming **1**

[CBSE Marking Scheme, 2017]

Detailed Answer :

(i) Presence of large amount of nutrients in water causes excessive growth of planktonic (free - floating) algae, called an algal bloom. Algal blooms cause deterioration of water quality and fish mortality. Some bloom forming algae are extremely toxic to human beings and animals.

(ii) Treatment of waste water before reaching pond by integrated water treatment is the preventive measure.

Answering Tip

- Connect water pollution to algal bloom. Advise students to carefully read and understand the requirement of the question before answering it.

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AI **Q. 12. Why lichens are regarded as pollution indicators ?** A **([Outside Delhi Set, 2013, Delhi Set, Comptt., 2009]**

Ans. Lichens are very sensitive to air pollution particularly caused by SO_2. Air pollution due to SO_2 destroy lichen population. They do not grow in such a polluted area. Therefore, they are regarded as indicators of pollution. **2**

Q.13. How did a citizen group called Friends of Arcata Marsh, California, USA, help to improve water quality of the marshland using Integrated Waste Water Treatment? Explain in four steps.
R **[Delhi/Outside Delhi, 2018]**

Ans. **(a)** Water is treated by conventional method // sedimentation / filtration / chlorination.
(b) Water flows to six connected marshes.
(c) The water in marshes is seeded with appropriate plants / algae / fungi / bacteria.
(d) Which helps to neutralize the pollutants / assimilate the pollutants / absorb pollutants / Remove heavy metals. ½ × 4
[CBSE Marking Scheme, 2018]

Q. 14. Why is *Eichhornia crassipes* nicknamed as ''Terror of Bengal''. R **[Delhi Set-I, 2012]**

Ans. *Eichhornia crassipes* is nicknamed as 'Terror of Bengal' because it grows luxuriantly in eutrophic water bodies. Its excessive growth causes blockage in our water ways, thereby leading to an imbalance in the ecosystem dynamics of water body. Its rate of excessive growth is higher than the rate of its removal. ''Terror of Bengal'' is the title given to this aquatic weed because initially it was introduced in water bodies of Bengal for its flowers and shape of leaves but however it turned out to be highly invasive water weed that not only spread in water bodies of Bengal but also throughout India. **2**

Short Answer Type Questions-II **(3 marks each)**

Q. 1. (i) Name any two places where it is essential to install electrostatic precipitators. Why is it required to do so ?
(ii) Mention one limitation of the electrostatic precipitator. R **[Delhi Set-I, 2016]**

Ans. **(i)** Thermal power plants/smelters/other particulate matter releasing industries. To remove particulate matter. **(Any two)**
(ii) Very very small particulate matter/less than 2.5 micrometres are not removed/velocity of air between plates must be low enough to allow the dust to fall/cannot work without electricity. **2 + 1**
[CBSE Marking Scheme, 2012]

Detailed Answer :

(i) In thermal power plants and automobile vehicles. It is because, electrostatic precipitator can remove particulate matter from their exhaust.
(ii) One of the major limitations of electrostatic precipitator is that it cannot remove particulates which are 2.5 micrometers or less in diameter, which may cause respiratory symptoms.

Q. 2. Our farmers still use DDT. How is this affecting the local bird population ?
A **[Delhi Set-I, Comptt. 2015]**

Ans. As a result of biomagnification, through an aquatic food chain, high concentration of DDT disturbs calcium metabolism in birds, which causes thinning of egg shell, and premature breaking, eventually leading to decline in bird population. **3**

Q. 3. "Determination of Biological Oxygen Demand (BOD) can help us in suggesting the quality of a water body." Explain. U **[Delhi Set-I, 2015]**

Ans. Biochemical Oxygen Demand (BOD) is the amount of dissolved oxygen required by the aerobic organisms to breakdown the organic material present in the water body at a certain temperature over a certain period of time. Natural water bodies contain a certain level of organic substances that are acted upon and decomposed by microbes.

Determining the BOD of water body establishes the amount of organic content in it. Presence of more organic wastes increase the biological activity. Thus, leading to algal blooms. High BOD value indicates more microbial activity, indicating that the water body is polluted. **3**

AI **Q. 4. Explain how biomagnification of DDT occurs in an aquatic food chain.**
R **[Foreign - 2017, Set - I, II, III]**

OR

With the help of a flowchart, show the phenomenon of biomagnification of DDT in an aquatic food chain. **[Outside Delhi Set-I, 2015]**

Ans. DDT in water taken up by an organism cannot be metabolised or excreted and thus passed on to successive trophic level in higher concentration. ½

Water (0.003 ppm) → Zooplankton (0.04 ppm) → Small fish (0.5 ppm) → Large fish (2 ppm) → Fish eating birds (25 ppm)

½ × 5 = 2½
[CBSE Marking Scheme, 2017]

Detailed Answer:

Biomagnification is the increase in the concentration of a toxin at successive trophic levels. The toxin gets accumulated in the body of an organism and is passed on to the next trophic level.

For example, DDT (dichlorodiphenyl trichloroethane) and other heavy metals such as mercury and calcium are the toxins that cause biomagnification.

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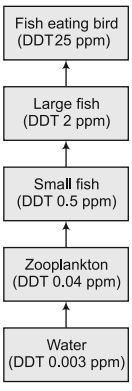
Flowchart showing biomagnification :



3

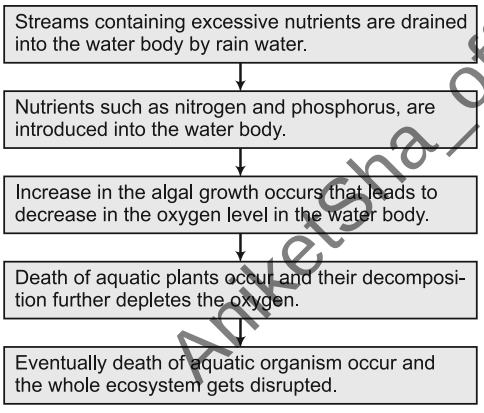
Answering Tip

- Practice drawing flow chart to explain the phenomenon of biomagnification of DDT in aquatic food chain.

Q. 5. With the help of a flowchart exhibit the events of Eutrophication.

U **[Outside Delhi Set-II, 2015]**

Ans. Enrichment of water body by excessive nutrients is called eutrophication. The events of eutrophication are as follows :



3

Q. 6. Presently, air quality of Delhi has significantly improved in comparison to what existed before 1997. This is the result of conscious human efforts. You are being asked to conduct an awareness programme in your locality wherein you will comment on the steps taken by Delhi Government to improve the air quality.

(i) Write any two of your comments.

(ii) List any two ways that you would include in your programme so as to ensure the maintenance of good quality of air.

(iii) State any two values your programme will inculcate in the people of your locality.

C **[Delhi Set-I, II, III, 2014]**

Ans. **(i) (a)** Use of CNG as fuel encouraged in vehicles.

(b) Improved public transport system like new fleet of DTC buses, Introduced Metro.

(c) Pollution check of vehicles was made mandatory.

(d) Availability of sulphur free fuel (Euro II norms). **(Any other suitable value)** **(Any two)** ½ + ½

(ii) (a) Car pool essential

(b) Use of bicycle

(c) Get your car pollution checked regularly **(Any other suitable example) (Any two)** ½ + ½

(iii) (a) Consciousness about the environment increase plantation activity

(b) Concern for others

(c) Improving social skills

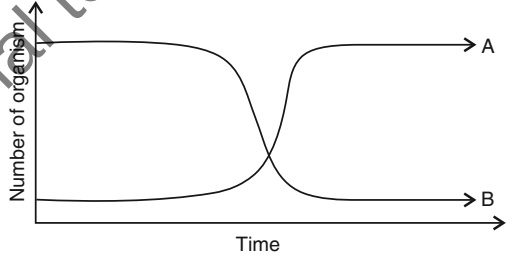
(d) Leadership quality ½ + ½

[CBSE Marking Scheme, 2014]

Answering Tip

- Clarify the causes and effects of various pollution under separate heads.

Q. 7. Two types of aquatic organisms in a lake show specific growth patterns as shown below, in a brief period of time. The lake is adjacent to an agricultural land extensively supplied with fertilizers.



Answer the questions based on the facts given above :

(i) Name the organisms depicting the patterns A and B.

(ii) State the reason for the growth patterns seen in A.

(iii) Write the effects of the growth patterns seen above. E & A **[Outside Delhi Set-II, 2014]**

Ans. **(i)** A–algae / planktonic (free floating) algae
B–fish / aquatic animals

(ii) Due to excessive loading of nutrients / fertilizers from adjacent agriculture land resulting in increase in nutrients.

(iii) Decrease in dissolved oxygen, increase in BOD, fish mortality, unpleasant odour / eutrophication. **3**

[CBSE Marking Scheme, 2014]

Answering Tips

- Understand thoroughly, the significance of BOD in an aquatic ecosystem. Also connect water pollution to algal bloom.
- Advise students to carefully read and understand the requirement of the question before answering it.

Q. 8. Why should the spraying of DDT as an insecticide on vegetable crops be banned ?

A **[Delhi Set-I, Comptt. 2013]**

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Ans. DDT is insoluble in water but soluble in fats. Due to low efficient transfer of energy from one trophic level to other, herbivores eat more DDT–polluted vegetables. Similarly, carnivores eat many herbivores. A predator stores much quantity of DDT with its prey continuously. This process continues for several years by which a significant concentration of DDT accumulates in top carnivores. DDT causes thinning of eggshells and their premature breaking, eventually causing decline in bird populations. **3**

Q. 9. How does a water body age naturally ? Explain. State how this phenomenon of ageing of a water body gets accelerated.

U [Delhi Set-II, Comptt. 2013]

Ans. The natural ageing of a lake is termed as eutrophication. In a young lake, the water is cold and clear, supporting little life. With time, streams draining into the lake introduce nutrients such as nitrogen and phosphorus, which encourage the growth of aquatic organisms. As the lake's fertility increase, plant and animal life flourishes, and organic remains begin to be deposited on the lake bottom. Over the centuries, as silt and organic debris pile up, the lake grows shallower and warmer, with warm-water organisms supplanting those that thrive in a cold environment. Marsh plants take root in the shallows and begin to fill in the original lake basin. Eventually, the lake gives way to large masses of floating plants (bog), finally converting into land. Depending on climate, size of the lake and other factors, the natural ageing of a lake may span thousands of years.

Pollutants from man's activities like effluents from the industries and homes can radically accelerate the ageing process. This phenomenon is called cultural or accelerated eutrophication.

(i) When sewage is discharged into a river, micro-organisms involved in biodegradation of organic matter in the receiving water body consume a lot of oxygen, and as a result there is a sharp decline in dissolved oxygen downstream from the point of sewage discharge. This causes mortality of fish and other aquatic organisms.

(ii) The presence of large amounts of nutrients in waters also causes excessive growth of planktonic algae, called an algal bloom, which imparts a distinct colour to the water bodies. Algal blooms cause deterioration of the water quality and causes fish mortality. Some bloom-forming algae are extremely toxic to human beings and animals. **3**

Q. 10. How does algal bloom destroy the quality of a fresh water body ? Explain.

A [Delhi Set-I, III, 2013]

Ans. The excessive growth of planktonic (free-floating) algae is called algal bloom. Nutrients present in sewage and fertilizers cause dense growth of plants and planktonic algae. Soon planktonic algae increase in number and impart a characteristic colouration to water. Algal bloom is toxic to animals and humans. It blocks light for submerged plants. There is a drastic decrease in oxygen due to which animals die. **3**

Q. 11. Explain the effect on the characteristics of river when urban sewage is discharged into it.

A [Delhi/Outside Delhi, 2018]

Ans. **(a)** Rise in organic matter, leads to increased microbial activity / growth of microbes

(b) It results in decrease in dissolved oxygen / rise in Biochemical Oxygen Demand

(c) Leads to fish mortality / algal bloom / colour change / foul odour / increase in toxicity

(Any two)

[1 + 1 + 1]

[CBSE Marking Scheme, 2018

Detailed Answer:

When organic wastes from the urban sewage enter the water bodies it serves as a food source for microorganisms such as algae and bacteria. As a result, the population of these microorganisms in the water body increases. Here, they utilize most of the dissolved oxygen for their metabolism. This results in increase in the levels of Biodegradable oxygen demand (BOD) in river water and results in the death of aquatic organisms. Also, the nutrients in the water lead to the growth of planktonic algae, causing alga bloom. It imparts a distinct colour to the water bodies and deteriorates the water quality resulting in death of fishes. Some bloom-forming algae are extremely toxic to human being and animals. **3**

Q. 12. Looking at the deteriorating air quality because of air pollution in many cities of the country, the citizens are very much worried and concerned about their health. The doctors have declared health emergency in the cities where the air quality is very severely poor.

(a) Mention any two major causes of air pollution

(b) Write any two harmful effects of air pollution to plants and humans.

(c) As a captain of your school Eco-club, suggest any two programmes you would plan to organize in the school so as to bring awareness among the students on how to check air pollution in and around the school.

C [Delhi/Outside Delhi, 2018]

Ans. **(a)** Vehicular discharge / smoke from industries / burning of agricultural wastes / smoke from incinerator / dust / smoke from thermal plants or any other correct cause.

(Any two)

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(b) Reduces growth of plants / reduces yields of crops / premature death of plants / respiratory problems / acid rain / any other relevant point. **(Any two – one from plant and one from human)**

(c) Plantation drive / awareness programmes through posters / nukkad natak / film show / rallies / debates or any other.

(Any two)

[1 + 1 + 1]

AI **Q. 13. (i) State the consequence if the electrostatic precipitator of a thermal plant fails to function.**

(ii) Mention any four methods by which the vehicular air pollution can be controlled.

A **[Delhi Set-I, 2011]**

Ans. **(i)** Particulate matter will pollute the air.

(ii) Vehicular pollution can be controlled by : Use of CNG/Phasing out of old vehicles / Use of unleaded petrol / Use of low sulphur fuel / Use of catalytic converters / Application of stringent pollution level. **1+2**

[CBSE Marking Scheme, 2011]

Answering Tip

- Discuss all the important measures to control pollution.

Q. 14. Particulate and gaseous pollutants alongwith harmless gases are released from the thermal power plants.

(i) Name any two harmless gases released.

(ii) Name the most widely used device for removing particulate pollutants from the air. Explain how the device is used ?

A **[Outside Delhi Set, II, 2011]**

Ans. **(i)** CO_2 & N_2.

(ii) The most widely used device for removing particulate pollutant from air is the electrostatic precipitator. It has electrode wires and a stage of collecting plates connected electrically with earth. The particles occurring in polluted air are charged electrically. These charged particles are passed over collecting plates. These particles settle down after losing their charge. **3**

Q. 15. Explain any three measures which will control vehicular air pollution in Indian cities.

A **[Outside Delhi Set, 2009]**

Ans. **The vehicular air pollution is chiefly controlled by**

(i) Promoting public transports like buses,metro trains,etc.

(ii) Use of low sulfur content petrol and diesel.

(iii) Use of Catalytic converters in vehicles which help in converting the pollutants to less toxic forms. **3**

Q. 16. A young sperm whale, 33-foot long was found dead off the coast. It had a large amount of human trash like trash bags, polypropylene sacks, ropes, net segments etc. amounting to 29 kilograms in its digestive system. The whale died because of inflammation of the abdominal lining. Analyze the possible reasons for such mishaps and suggest measures that can be taken to reduce such incidents.

A **[CBSE SQP, 2018]**

Ans. Due to cheap and quick production, durability and usefulness in several applications, plastic has become desired material for creating objects like trash bags, polypropylene sacks, ropes, net segments. But plastic is non-biodegradable product and extremely harmful. These plastic products get transported to nearby rivers and to oceans. These products are swallowed by marine animals mistaken it to be a food. Thus, plastic, once ingested, cannot be digested or passed by an animal so it stays in the gut leading to their death.

Measures that could be taken to reduce such mishaps are:

(a) We can support government's initiative across the country for reducing the use of plastics and use of eco-friendly packaging.

(b) We can do our bit by carrying cloth or other natural fibre carry-bags when we go for shopping and by refusing to take the polythene bags from shopkeepers.

(c) It is important that all garbage generated is sorted. The biodegradable materials can be put into deep pits in the ground and be left for natural breakdown. It leaves only the non-biodegradable to be disposed of, the quantity of which should be minimized. The need to reduce our garbage generation should be a prime goal.

(Any three) 1 ½ + 1½

[CBSE Marking Scheme, 2018]

Answering Tip

- Discuss all the important measures to control pollution.

Q. 17 Why is the concentration of toxins found to be more in the organisms occupying the highest trophic level in the food chain in polluted water body? Explain with the help of suitable example. R **[Foreign Set, 2013]**

Ans. Concentration of toxins is more in organisms occupying the highest trophic level in the food chain. It is because of **biomagnification.** It goes on increasing at each trophic level of a food chain and is therefore maximum in the organisms of highest trophic level due to their increasing accumulation at each trophic level. For example DDT was used to control mosquitoes in a lake of USA. It was noted that the DDT found in phytoplantktons was about 800 times higher than that present in the lake and zooplanktons had about 13 times more DDT than that in phytoplanktons. **3**

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Long Answer Type Questions (5 marks each)

AI **Q. 1. (i) Public transport in Delhi uses CNG since 2002. List the advantages of this fuel policy.**

(ii) BOD was measured in two different places A and B of a river in the direction of its flow. BOD value was higher at A than B. What do you infer from this observation and why ?

E & A **[Outside Delhi Set-I, II, Comptt. 2013]**

Ans. (i) Delhi Government shifted to CNG (Compressed Natural Gas) because :

(a) It burns more efficiently, unlike petrol or diesel, in automobiles and very little of it is left unburnt.

(b) CNG is cheaper than petrol and diesel.

(c) It cannot be siphoned off by thieves.

(d) It cannot be adulterated like petrol or diesel.

(ii) Biochemical oxygen demand (BOD) refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria.

As the BOD value is higher at A, therefore, the amount of dissolved oxygen is lower in that place.

Excessive growth of algae, plants and animals in water bodies due to the nutrient enrichment, particularly with nitrogen and phosphorus, and discharge of domestic sewage into a river results in the rise of BOD. However, as the organic matter is decomposed, there is a gradual rise in the amount of dissolved oxygen downstream. **2½ + 2½**

Q. 2. A national newspaper reported that a 50 metre high 'Sanitary landfill', the dumping site of city's garbage in one of the metro-cities crashed and caused heavy damage and disaster in and around the area. A couple of cars, two-wheelers and cattle were swept away in the nearby overflowing canal. Three persons including a young girl were crushed under the garbage and died.

(a) Write any two points that in your opinion could have caused this landfill crash.

(b) Mention any four preventive measures to be adhered to as a policy which could have avoided this accident.

(c) Write any two suggestions that you would like to give to the citizens so as to help in preventing such a disaster in future.

C **[Delhi/Outside Delhi, Comptt, Set 1,2,3, 2018]**

Ans. (a) Lack of proper waste management measures, overloading of landfill area ½ + ½

(b) Prevent overloading of any designated landfill, litter control through covering material/ soil regularly, litter load should be compacted, create temporary / permanent fencing, regular monitoring of landfill area, engineers to design landfills habitat (any other appropriate points) (Any four) ½ × 4

(c) Reduce use of disposable material, recycle waste as much as possible, start making compost pile for food scraps, use reusable fabric shopping bags, avoid creating trash (any other appropriate measure)

(Any two) 2

[CBSE Marking Scheme, 2018]

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TOPIC-2
Greenhouse Effect, Global Warming and Ozone Depletion

Revision Notes

➢ **Greenhouse Effect & Global Warming**

- Greenhouse is a small glass house used for growing plants during winter under controlled conditions.
- The glass panel lets the light in, but does not allow heat to escape.
- Therefore, the greenhouse warms up.
- Greenhouse effect is a natural phenomenon responsible for heating of Earth's surface and atmosphere.
- It maintains the present average temperature (15°C).
- Without greenhouse effect, the average temperature at Earth surface would have been very cold. (–18°C).
- Clouds and gases reflect about 1/4th of the incoming solar radiation, and absorb some of it.

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- But almost half of incoming solar radiation falls on Earth's surface heating it, while a small proportion is reflected back.
- Earth's surface re-emits heat as infrared radiation.
- But a part of infrared is absorbed by atmospheric gases (CO_2, CH_4 etc.) and so cannot escape into space.
- These greenhouse gases (commonly - carbon dioxide and methane) radiate heat energy, and a major part of which again comes to Earth's surface, thus heating it up again.
- These gases cause the greenhouse effect.
- Increase in the level of greenhouse gases has led to global warming (overheating of Earth land).
- During the past century, the temperature of Earth has increased by 0.6°C, most of it during the last 3 decades.

➢ **Global Warming**

- The gradual rise in temperature of earth surface due the accumulation of green house gases is called as global warming. It has led to deleterious changes in the environment resulting in odd climatic changes (E.g. El Nino effect).

➢ **Impacts of Climate Change :**

(a) It has been observed that in the past three decades, the average temperature of the Earth has increased upto 0.6ºC. As a result, the natural water cycle has been disturbed, which has resulted an abrupt changes in the pattern of rainfall. It also changed the amount of rain water.

(b) Melting of Polar ice caps and mountain glaciers. This has caused a rise in the sea level, leading to the inundation of coastal regions.

(c) The upper parts of atmosphere have become cooler due to reduced passage of long wave radiations. This in turn had led to shrinkage of atmosphere.

➢ **Climate Change mitigation :**

(a) Climate change is a real and serious issue. We need to act promptly to mitigate (reducing the severity, seriousness or painfulness of something) its effects.

(b) Climate change mitigation consists of actions to limit the magnitude or rate of long-term climate change. It generally involves reductions in human (anthropogenic) emissions of greenhouse gases (GHGs). Mitigation may also be achieved by increasing the capacity of carbon sinks, e.g., through reforestation.

(c) Mitigation policies can substantially reduce the risks associated with human-induced global warming.

➢ **Examples of mitigation:**

(a) Phasing out fossil fuels by switching to low-carbon energy sources, such as renewable and nuclear energy

(b) Expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere.

➢ **Goals of mitigation :**

(a) To avoid significant human interference with the climate system.

(b) To stabilize greenhouse gas levels in a time frame sufficient to allow ecosystems to adapt naturally to climate change

(c) To ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

➢ **Ozone Depletion in the Stratosphere**

- There are two types of ozone- Bad ozone and Good ozone.
- 'Bad' ozone is an air pollutant and is formed in the lower atmosphere **(troposphere)**.
- It harms plants and animals.
- The 'good' ozone is found in the **stratosphere**.
- It acts as a shield absorbing ultraviolet radiation from the sun.
- UV rays are highly injurious since they cause mutation.
- The thickness of the ozone (O_3) in a column of air from the ground to the top of the atmosphere is measured in terms of **Dobson units** (DU).
- Ozone is continuously formed by the action of UV rays on molecular oxygen, and also degraded into molecular oxygen in the stratosphere.
- Production and degradation of ozone in the stratosphere should be balanced.

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- But the balance is disrupted due to ozone degradation by **chlorofluorocarbons (CFCs) gas.**
- CFCs (used as refrigerants) move upward and reach stratosphere. UV rays act on them releasing Cl atoms.
- In the presence of Cl (catalyst), ozone degrades releasing molecular oxygen (O_2) causing ozone depletion.
- It has formed ozone hole over the Antarctic region.
- UV radiation of wavelengths shorter than UV-B, are almost completely absorbed by Earth's atmosphere.

➢ **Effects of UV-B**

(a) UV-B causes mutation of DNA.

(b) It causes ageing of skin, damage to skin cells and skin cancers.

(c) A high dose of UV-B causes inflammation of cornea (snow-blindness), cataract, etc.

(d) It permanently damages the cornea.

➢ **Montreal Protocol**

- The Montreal Protocol (an international treaty in Canada, 1987) was signed to control the emission of ozone depleting substances.
- Many more efforts have been made and protocols have laid down definite roadmaps, separately for developed and developing countries, for reducing the emission of CFCs and other ozone depleting chemicals.

➢ **Soil Erosion and Desertification**

- Human activities like over-cultivation, deforestation, grazing and poor irrigation practices, lead to soil erosion.
- It results in arid patches of land and desertification.
- Increase in urbanization also creates desertification.

➢ **Water Logging and Soil Salinity**

- These are the problems as a part of Green Revolution.
- Irrigation without proper drainage of water leads to water logging in the soil.
- It draws salt to the surface of the soil.
- The salt is deposited on the land surface or collects at the plant roots.
- This damages the agriculture.

➢ **Deforestation**

- It is the conversion of forested areas to non-forested ones.
- Almost 40% forests have been lost in the tropics, compared to only 1% in the temperate region.
- National Forest Policy (1988) of India has recommended 33% forest cover for the plains and 67% for the hills.
- We have only 19.4% of forest cover (it was about 30% at the beginning of 20th century).

➢ **Reasons of Deforestation**

(a) Conversion of forest to agricultural land.

(b) For timber, firewood, cattle ranching etc.

(c) **Slash & burn agriculture (Jhum cultivation)** in the north-eastern states of India. In this, the farmers cut down the trees of the forest and burn the plant remains. The ash is used as a fertiliser and the land is then used for farming or cattle grazing. After cultivation, the area is left for several years so as to allow its recovery. In earlier days,enough time-gap was given for recovery. With increasing population and repeated cultivation, this recovery phase is decreased, resulting in deforestation.

➢ **Consequences of Deforestation**

(a) CO_2 concentration in the atmosphere is enhanced because trees that could hold a lot of carbon in their biomass are lost with deforestation

(b) Loss of biodiversity due to habitat destruction

(c) Disturbs hydrologic cycle

(d) Soil erosion and desertification

➢ **Reforestation**

(a) The process of restoring a forest that once existed in the past is known as reforestation.

(b) It may occur naturally in a deforested area.

(c) We can speed it up by planting trees.

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Two Case Studies of People's Participation in Conservation of Forests

(a) Bishnoi Movement

- In 1731, the king of Jodhpur in Rajasthan asked to arrange wood for constructing a new palace.
- The minister and workers went to a forest near a village, inhabited by Bishnois.
- The Bishnois thwarted them from cutting down the trees.
- A Bishnoi woman, Amrita Devi hugged a tree.
- Sadly, the king's men cut down the tree along with Amrita Devi.
- Her three daughters and hundreds of other Bishnois followed her, and thus lost their lives saving trees.
- Government of India has instituted the Amrita Devi Bishnoi Wildlife Protection Award for individuals or communities from rural areas for extra ordinary courage and dedication in protecting wildlife.

(b) Chipko Movement of Garhwal Himalayas

- In 1974, local women of Garhwal Himalayas participated to protect trees from the axe of contractors by hugging them.
- Realizing the significance of participation by local communities, the Government of India in 1980s has introduced the concept of **Joint Forest Management (JFM)** so as to work closely with the local communities for protecting and managing forests.
- In return for their services to the forest, the communities get benefit of various forest products (*e.g.*, fruits, gum, rubber, medicine, etc.), and thus the forest can be conserved in a sustainable manner.

Very Short Answer Type Questions (1 mark each)

AI **Q. 1. Name the greenhouse gases that contribute to total global warming.**

R **[Delhi Set-II, 2014]**

Ans. Nitrous oxide (N_2O), chlorofluorocarbon (CFC), methane (CH_4), carbon dioxide (CO_2). **1**

[CBSE Marking Scheme, 2014]

Answering Tip

- Students often write incorrect names / formula of green house gases.

Q. 2. State the purpose of signing the Montreal Protocol. R **[Delhi Set-II, III, 2014]**

Ans. To control the emission of ozone depleting substances. **1**

[CBSE Marking Scheme, 2014]

Q. 3. Name two gases contributing the maximum to the green house effect.

R **[Delhi Set-III, Comptt, 2014]**

Ans. Carbon dioxide (40%) and methane (20%) are the two gases which are contributing the maximum to green house effect. **1**

Q. 4. Where is good ozone present? Why is it called so ? U **[Outside Delhi Set, Comptt., 2014]**

Ans. Good ozone is present in the upper part of atmosphere called stratosphere. It is called as good ozone because it absorbs the ultra-violet radiation of the sun and acts as a shield which does not allow the harmful UV-radiations to enter the earth's atmosphere. **1**

Commonly Made Error

- Students often get confused between good ozone and bad ozone. Understand the differences in tabular form.

Q. 5. Write the unit used for measuring ozone thickness.

R **[Outside Delhi Set-I, 2011]**

Ans. Dobson unit (DU). **1**

[CBSE Marking Scheme, 2011]

Q. 6. Mention the cause of thinning of ozone layer.

U **[Delhi Comptt. 2011]**

Ans. Thinning in the ozone layer is caused by increasing concentrations of ozone-depleting chemicals like chlorofluorocarbons or CFCs. **1**

AI **Q. 7. How does Jhum cultivation promote deforestation ?**

U **[Outside Delhi Comptt. 2011]**

Ans. In Jhum cultivation the farmers cut down the trees of the forest and burn the plant remains. The ash is used as a fertilizer, and the land is used for farming or cattle grazing. After cultivation, the area was left for several years so as to allow its recovery but with increasing population, and repeated cultivation, the recovery phase in Jhum cultivation has been done away, resulting in deforestation. 1

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Answering Tip

- Learn the relevant points related to the Jhum cultivation is just a agricultural practice not any movement or any leaders associated with it.

Q. 8. How is snow blindness caused in humans ?

R **[Outside Delhi Set, 2010]**

Ans. Snow blindness (inflammation of cornea) is caused by absorption of UV-B radiations. **1**

Short Answer Type Questions-I (2 marks each)

Q. 1. Explain the relationship between CFC's and ozone in the stratosphere. R **[Outside Delhi Set-I, 2016]**

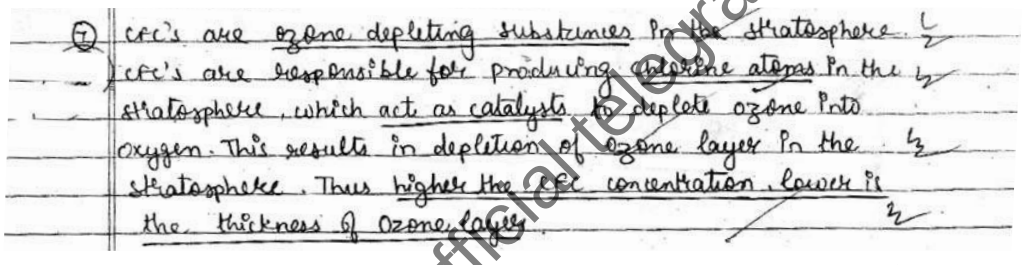
Ans. UV rays act on CFC's, release *Cl* atom, which act on ozone to release O_2 resulting in ozone layer depletion/ causing ozone hole. **[CBSE Marking Scheme, 2016]** ½ × 4 = 2

Detailed Answer :

The ozone layer is getting depleted by the action of CFCs (Chlorofluorocarbons) used as coolant in refrigerators. UV rays act on CFCs releasing Cl atoms. In presence of Cl (catalyst), ozone degrades releasing molecular oxygen (O_2). This causes ozone depletion. **2**

OR

Ans.



[Topper's Answer, 2016]

Q. 2. What is a 'green house' effect ? How is this phenomenon used for growing plants especially in winter ? R **[Delhi Set-II, Comptt. 2016]**

Ans. The green house effect is a naturally occurring phenomenon that is responsible for heating of earth and atmosphere. Green house gases like CO_2 absorb the infrared radiation of the sun and prevent it from escaping. **1**

A green house which is like a small glass house is used for growing plants during winter as it provides the appropriate temperature to the plants, as the glass also prevents the IR radiation from escaping thereby increasing the temperature inside. ½+½=1

[CBSE Marking Scheme, 2016]

Answering Tip

- Practice writing the definition fo greenhouse effect emphasizing on operative terms.

Q. 3. Why are the environmentalists worried about the considerable increase in the level of green house gases? List the different greenhouse gases other than carbon dioxide.

A **[Delhi Set,III, Comptt., 2016]**

Ans. Increase in the level of green house gases has led to heating of earth leading to global warming/ melting of glaciers/ rise in sea level that can flood the coastal areas. **(Any two)** ½+½

Greenhouse gases other than CO_2 are:

Methane (CH_4), Chlorofluorocarbon(CFCs), Nitrous oxide (N_2O). ½+½

[CBSE Marking Scheme, 2016]

AI **Q. 4. (i) Rearrange the following greenhouse gases in increasing order of their relative contribution to the total global warming :**

N_2O, CFC; CO_2; C_2H_4

(ii) What is the effect of global warming on polar ice-caps ? Comment on its possible ecological impact.

U **[Foreign Set-I, 2016]**

Ans. **(i)** $C_2H_4 \rightarrow N_2O \rightarrow CFC \rightarrow CO_2/N_2O \rightarrow CFC \rightarrow CH_4 \rightarrow CO_2$ (Highest)

(**Note :** Ignore C_2H_4/CH_4 and give one mark for remaining three greenhouse gases if sequence is correct.)

(ii) (Global warming) → Rise in Atmospheric temperature → polar ice melts → increase in sea level → coastal land mass submerge.

½ × 4 = 2

[CBSE Marking Scheme, 2016]

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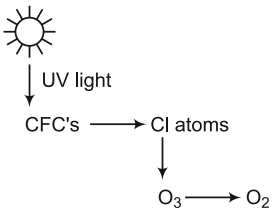
Commonly Made Error

- Many students misplaced the terms and hence could not write the correct logical sequence.

Answering Tips

- Practice writing the names of greenhouse gases in increasing order of their relative contribution to global warming.
- Learn the effects of global warming under the following heads: 1. Weather and Climate 2. Animals and plants 3. Food production

Q. 5.



(i) What are the after effects of the degradation of ozone ?

(ii) How does it affect human health.

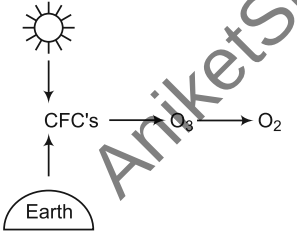
U **[Delhi Comptt. Set-I, 2015]**

Ans. **(i)** Thinning of Ozone / Ozone depletion / UV-B penetrates Ozone-forms hole-reaches earth. **1**

(ii) UV-B damages DNA causes mutation, ageing of skin / damage of skin cells / skin cancer / inflammation of cornea (snow blindness, cataract) **(Any two) ½+½**

[CBSE Marking Scheme,2015]

Q. 6.



(i) Expand CFC.

(ii) How does it reduce ozone to oxygen ?

R **[Outside Delhi Set-II, Comptt. 2015]**

Ans. **(i)** Chlorofluorocarbon. **1**

(ii) CFC move upward and reach stratosphere. UV-rays act on them releasing Cl atom due to which ozone degrades releasing molecular oxygen. **1**

[CBSE Marking Scheme, 2015]

Commonly Made Error

- Students often write incorrect expansion of CFC. It seems they are unaware of this acronym.

Answering Tip

- Learn acronyms with proper understanding.

Q. 7. (i) State the cause of depletion of ozone layer.

(ii) Specify any two ill-effects that it can cause in the human body.

U **[Foreign Set, Delhi Set-III, 2014]**

Ans. **(i)** UV radiations acts upon CFCs (chlorofluorocarbons), releasing Cl atoms (in the stratosphere), the Cl atoms degrade ozone.

(ii) Ageing of skin / skin cancer, inflammation of cornea / snow blindness / cataract / permanently damaged cornea.

(Any two) 2

[CBSE Marking Scheme, 2014]

Detailed Answer :

(i) The main cause of depletion of ozone layer is the increase in ozone degradation by chlorofluoro carbons (CFCs)

(ii) Its effects on human body are :

(a) It allows/UV B radiation to enter the atmosphere.

(b) Causes inflammation of cornea (snow blindness) cataract. etc.

(c) Causes ageing of skin, damage the skin cell and may even cause cancer.

Q. 8. List four benefits on human life by eliminating the use of CFCs. **[Outside Delhi - 2017, Set - I, II, II]**

Ans. **(i)** Delay in ageing of skin

(ii) Prevent damage to skin cells

(iii) Prevent skin cancer

(iv) Prevent snow blindness / inflammation of cornea

(v) Prevent cataract

(vi) Prevents ozone depletion

(vii) Prevents global warming

(viii) Reduces greenhouse effect

(ix) Reduces odd climatic changes or El Nino effect **(Any four) ½ × 4**

R **[CBSE Marking Scheme, 2017]**

OR

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Ans.

7) Chlorofluorocarbons when eliminated will impart the following benefits to human life :-

i) ozone depletion can be prevented thereby the exposure of living organisms to harmful ultraviolet radiations can be reduced

ii) CFCs are also ~~a~~ a cause of global warming. Its elimination will enable the reduction of the rate of increase of global temperature

iii) ~~The leakage~~ The elimination of CFCs will in a way result in decreased rates of skin cancer due to decrease in ozone depletion. Also it is beneficial for the improvement of our immune system

iv) CFCs are hazards to our natural environment Their elimination will result in decreased harm to nature due to human activities

v) Elimination of CFCs will control pollution of our environment

[Topper's Answer, 2017]

Q. 9. Why are the there regular reminders to reduce the use of CFCs in the production of industrial and household appliances ? Explain.

U **[Foreign 2017, Set - II]**

Ans. **(i)** CFC adds to degradation of ozone layer in the stratosphere

(ii) Ozone shields the earth by absorbing UV radiation from sun

(iii) UV rays are highly injurious to organisms

(iv) To prevent degradation of ozone layer (in stratosphere) / to maintain a balance between production and degradation of ozone in stratosphere **½ × 4 = 2**

Q. 10. Justify the need for signing of Montreal Protocol by the participating nations.

A **[Foreign 2017, Set – II]**

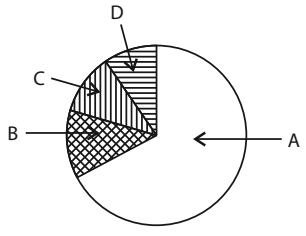
Ans. **(i)** Observing the deleterious affects of ozone depletion the Montreal Protocol was signed to control emission of ozone depleting substances / for reducing emission of CFCs and other ozone depleting chemicals. **1**

(ii) Protocols have laid down definite road maps for developed and developing countries **1**

Q. 11. Explain the relationship between green house gases and global warming. U **[Foreign 2017, Set - I]**

Ans. Green house gases absorb a major fraction of infra red radiation, emitted by earth, and do not allow it to escape into space and reflects it back to earth, leading to considerable heating of earth and its atmosphere causing global warming. **½ × 4 = 2**

Q. 12. The figure given below shows the relative contribution of four green house gases to global warming.



(i) Identify the gas A & C.

(ii) Why are these four gases called the green house gases. A **[Foreign Set, 2011]**

Ans. **(i)** A — CO_2 (60%)

B — CH_4 (20%)

C — CFCs (14%)

D — N_2O (6%)

(ii) These four gases are called greenhouse gases because the molecules of their gases absorb major fraction of infrared radiation emitted by earth and radiate it back ,thus heating up the earth's surface ,causing greenhouse effect. **1 + 1**

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Short Answer Type Questions-II (3 marks each)

Q. 1. How have human activities caused desertification? Explain. A **[Delhi Set-I, 2013]**

Ans. Desertification is a type of land degradation in which relatively dry land region becomes increasingly arid.

Human activities responsible for desertification are as follows :

(i) Deforestation (slash and burn and destruction of plants that retain water and shade land).

(ii) Introduction of invasive species.

(iii) Cattle grazing or overgrazing.

(iv) Improper farming practices.

(v) Excessive ploughing of land may also cause soil erosion. **(Any three) 3**

Q. 2. How do human activities cause desertification. U **[Delhi Set, Comptt., 2009]**

Ans. Unrestricted grazing, over cultivation, poor irrigation practices etc. are the human activities which usually result in small arid patches of land. When these barren patches of land extend and remain unattended for a long time, a desert is formed *i.e.* the desertification is caused. 3

AI **Q. 3. (i) Expand CFCs.**

(ii) CFCs are a part of greenhouse gases. Name the other gases.

(iii) Explain the major harms caused by these gases.

(iv) Mention the consequences of the degradation of O_3. U **[Outside Delhi Set, Comptt., 2009]**

Ans. **(i)** Chlorofluorocarbons.

(ii) CO_2, CH_4, N_2O

(iii) These gases absorb radiations that come to earth's surface and heat it.

(iv) Degradation of ozone layer is very harmful to the mankind. It damages the human skin cells. It may reduce breaks in the chemical bond of DNA molecules and cause mutation.

½ + ½ + 1 + 1

Q. 4. What is ozone shield and why is it important ? Name the gases that cause stratospheric ozone depletion. R **[Delhi Set, 2007]**

Ans. Ozone shield is a part of stratosphere in which the concentration of ozone is very high. It is called as ozone shield because it prevents the sun's UV-radiations entering the earth atmosphere. In this way it protects the living beings from harmful effects of these radiations. Stratospheric ozone depletion results in the impairment of photosynthetic machinery in green plants, which increases CO_2 concentration and result in global warming and skin cancer and cataract in humans.

CFCs and CH_4 gases cause damage to ozone shield. **2+1**

Long Answer Type Questions (5 marks each)

AI **Q. 1. (i) What is El Nino effect ? Explain how it accounts for biodiversity loss.**

(ii) Explain any three measures that you as an individual would take to reduce environmental pollution. E & A **[Delhi Set-I, 2014, 2011]**

Ans. **(i) El Nino effect :** El Nino is a severe atmospheric and oceanic disturbance in the Pacific Ocean that occurs every seven to fourteen years. It is called El Nino, meaning 'the Christ Child', because it usually appears near the Christmas season. Warm surface waters flow from the central Pacific towards eastern Pacific.

El Nino effects are actually thought to be potentially more damaging on global scale, as they may cause floods and mudslides in Latin America.

(ii) The three measures that we as an individual would take to reduce environmental pollution are :

(a) Turning off the air conditioners when not in use.

(b) Planting more and more trees.

(c) Reducing the use of plastics.

(d) Composting biodegradable kitchen waste.

(Any three) 2 + 3 = 5

Q. 2. (i) What depletes ozone in the stratosphere ? How does this affect human life ?

(ii) Explain biomagnification of DDT in an aquatic food chain. How does it affect the bird population ?

U **[Outside Delhi Set-II, 2014; Delhi Set-I, 2012]**

Ans. **(i) Chlorofluorocarbons** (CFCs) are added to the stratosphere, which have a permanent and continuing effect on ozone levels. This leads to the depletion of ozone layer.

Ozone depletion causes UV radiations to increase about 10%, which results in various diseases including skin cancer and eye disease.

(ii) Biomagnification means increase in concentration of toxic waste at successive trophic levels of DDT. Biomagnification of DDT at an aquatic food chain causes the increase in concentration of DDT at successive trophic levels:

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Water (0.003 ppm) → Zooplankton (0.04 ppm) →Small fish (0.5 ppm) → Large fish (2 ppm) → Fish eating birds (25 ppm)

DDT interferes the eggshell formation in many birds. It causes premature breaking of eggshells, eventually causing decline in bird populations.

2½ + 2½ = 5

Q. 3. (i) Why is the ozone layer required in the stratosphere ? How does it get degraded ? Explain.

(ii) Why is the ozone depletion a threat to mankind ? A **[Delhi Set-II, Comptt. 2013]**

Ans. **(i)** The ozone formed in the stratosphere is called 'good' ozone, as it acts as a shield and absorbs the ultraviolet radiation from the sun.

The major ozone-depleting substances are chlorofluorocarbons, which release active chlorine in the presence of UV. The chlorine atoms degrade ozone into molecular oxygen.

$CFCl_3 \xrightarrow{UV(C)} CFCl_2 + Cl$

$CFCl_2 \xrightarrow{UV(C)} CFCl + Cl$

$Cl + O_3 \rightarrow ClO + O_2$

$ClO + O_3 \rightarrow Cl + 2O_2$

(ii) **(a)** The thinning of the ozone layer results in an increase in the UV radiation reaching the earth's surface. 5% loss of ozone results in a 10% increase in UV radiation.

(b) In humans, the increased UV radiation increases the incidence of cataract and skin cancer (including melanoma) and diminishes the functioning of the immune system.

(c) Elevated levels of UV radiation affect photosynthesis as well as damage nucleic acids in living organisms. UV radiation inhibits photosynthesis in most phytoplankton as it penetrates through the clear open ocean water.

(d) This, in turn, can affect the whole food chain of organisms that depends on the phytoplankton. **5**

Q. 4. (i) Write the percentage of land area that was covered by forests by the end of the last century.

(ii) Describe any two practices that led to deforestation.

(iii) State the consequences of deforestation.

(iv) Suggest a method to overcome deforestation.

R **[Outside Delhi Comptt. - 2017, Set – I, II, III]**

Ans. **(i)** 19.4% ½

(ii) **(a)** Trees are axed for timber / firewood / land for industrial requirement

(b) Slash and burn agriculture

(c) Habitat loss and fragmentation - clearing of forest land into grass land for raising cattle. **(Any two) 1 + 1**

(iii) **(a)** Deterioration of our environment in terms of air, water and soil quality.

(b) Causes loss of biodiversity.

(c) Disturbance in hydrological cycle / biogeochemical cycle **(Any two) 1 + 1**

(iv) Reforestation or any other appropriate alternative ½

[CBSE Marking Scheme, 2017]

Q. 5. People living in the coastal areas are forced to evict their dwelling units as the sea has inundated into the land areas. State the possible reasons and suggest measures that could be taken to reduce the deleterious changes in the environment.

A **[CBSE SQP, 2018]**

Ans. Increase in the level of greenhouse gases has led to considerable heating of Earth leading to global warming; the temperature of Earth has increased by 0.6 °C most of it during the last three decades. **1½**

El Nino effect is leading to increased melting of polar ice caps as well as of other snow caps. This has resulted in a rise in sea level that can submerge many coastal areas. **1½**

The measures include

(a) Cutting down use of fossil fuel,

(b) Improving efficiency of energy usage

(c) Reducing deforestation and planting trees.

(d) Slowing down the growth of human population.

(e) Reduce the emission of greenhouse gases into the atmosphere.

(Any four points; ½ a mark each × 4=2)

[CBSE Marking Scheme, 2018]

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Know the Terms

- **Acid rain :** It is caused by presence of excess of nitrogen oxides, sulphur dioxide and chlorides in the atmosphere.
- **Algal bloom :** The excessive growth of alga in fresh or marine water, often resulting in discoloration of water.
- **Biomagnification :** Increase in the concentration of pollutants or harmful chemicals with an increase in the trophic level.
- **Catalytic converters :** These are devices fitted in automobiles to reduce vehicular pollution.
- **Defunct Ships :** A type of solid waste that need proper disposal.
- **Dobson units :** The unit of measuring the thickness of the ozone layer .

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- **DU :** Dobson unit
- **E wastes :** These are electronic wastes that generally include electronic good such as computers etc.
- **Ecological sanitation :** It is a sustainable system for handling human excreta, using dry composting toilets.
- **Ecosan :** Ecological sanitation (Sustainable handling of human excreta)
- **Electrostatic precipitator :** It is the device widely used to remove particulate matter such as dust, smoke etc. from air using force of an electrostatic charge.
- **Eutrophication :** It is the natural ageing process of a lake caused due to nutrient enrichment.
- **FOAM :** Friends of Arcata Marsh
- **Global warming :** It is defined as an increase in the average temperature of the Earth's surface.
- **Greenhouse effect :** The greenhouse effect refers to an overall increase in the average temperature of the Earth due to the presence of greenhouse gases.
- **Mulching :** Artificial cover used to save the land.
- **Noise :** It is undesired high level of sound.
- **Oil spill :** Spontaneous discharge of oil, petroleum in estuaries and oceans.
- **Ozone depletion :** It is the reduction in concentration of ozone layer.
- **Ozone hole :** The formation of a large area of thinned ozone layer.
- **PIL :** Public Interest Litigation
- **Polar Vertex :** Complete separation of Antarctica air from rest of the world by natural circulation of wind.
- **Pollutants :** Agents that cause pollution are called as pollutants.
- **Pollution :** It is defined as any undesirable change in physical, chemical or biological characteristics of air, land, water or soil.
- **Smog :** Smog a dark brown smoky mist that occurs in cold weather. It is a mixture of smoke, dust particles and small drops of fog.

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