Read the question carefully and address exactly what is asked, avoiding unnecessary deviation.

Start with a clear and relevant introduction that shows understanding of the topic.

Structure the answer logically: introduction, explanation/analysis, and a brief conclusion.

Use correct scientific terminology (e.g., biodiversity, sustainability, carbon cycle, eutrophication).

Explain concepts clearly and accurately, avoiding vague or generalized statements.

Support answers with relevant examples, preferably from Pakistan or global case studies where appropriate.

Include data, statistics, or facts (e.g., temperature rise, deforestation rates) when relevant to strengthen arguments.

Incorporate environmental laws, agreements, or protocols (e.g., Paris Agreement, Kyoto Protocol, SDGs) where applicable.

Show cause-and-effect relationships in environmental processes.

Focus on analysis and application rather than rote definitions.

Present balanced views by mentioning impacts,

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1. Early Phase (1947-1970s)

Environmental concerns weren't prioritized immediately after independence. focus was on economic development and nation-building. Limited environmental legislation existed, mostly sectoral laws (e.g Forest Act 1927, Water Pollution Control ordinances). Conservation efforts were largely forestry and wildlife focused, with agencies under provincial control.

1947 → SECTORAL AND CONSERVATION APPROACH → 1970

2. Institutional Awareness: (1970s-1980s)

Emergence of environmental consciousness due to global movements (UN-Stockholm conference, 1972). There was establishment of Pakistan Environmental Protection Council (PEPC) in 1973 under the ministry of environment. Early attempts were made to integrate environment with development planning. The focus was on pollution control and wildlife conservation, but,

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Implementation was weak.

3. Legal and Policy Framework: (1980s-1990s)

There was introduction of **environmental legislation:**

- **Pakistan Environmental Protection Ordinance (PEPO) 1983:**

This was first major environment law, emphasis on **industrial pollution** and environmental standards.

- Establishment of provincial **environmental boards** in Sindh, Punjab, and NWFP.
- Initiatives included **Environmental Impact Assessment (EIA)** for projects.

PEPO → → Provincial Boards → → EIA Process

4. Modern Environmental Governance: (2000s - Present)

- **National Environmental Policy (NEP)**

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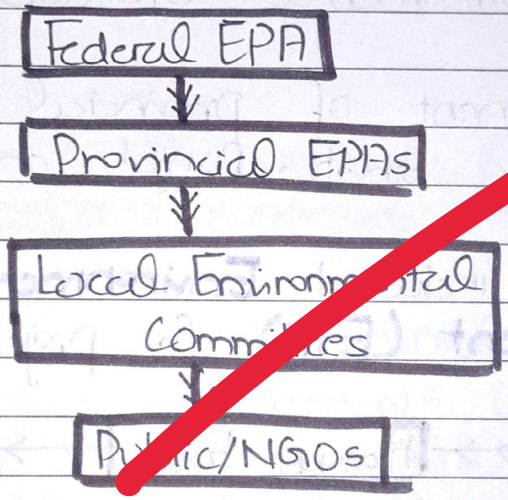
2005: Integrates sustainable development with economic planning.

- Establishment of **Environmental Protection Agencies (EPA)** at federal and provincial levels.
- key laws updated: PEPA 1997, National climate change Policy 2012, Pakistan climate change Act '2017. It was focussed on air and water pollution control, biodiversity conservation, climate change adaptation and mitigation and waste management.
- Participation in international treaties: **Montreal protocol, UNFCCC, convention on Biological Diversity.**



5. CHALLENGES:

The challenges include: **weak enforcement of laws**, insufficient funding and capacity for EPAs, **rapid urbanization**

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and industrial growth outpacing regulations, lack of public awareness and coordination between federal and provincial bodies.

6. CONCLUSION:

Environmental governance in Pakistan has evolved from ad hoc conservation to structured, policy-driven management while frameworks exist, the focus must shift toward implementation, public participation, and climate resilience to ensure sustainable development.

PART (B)

1. INTRODUCTION:

Climate change refers to long-term alterations in temperature, precipitation, wind patterns, and other aspects of the Earth's climate system. Unlike short-term weather variability, climate change occurs over decades or centuries and is largely driven by anthropogenic activities such as burning fossil fuels, deforestation, and industrialization. It is

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considered one of the most pressing global challenges, impacting ecosystems, agriculture, human health, water resources, and the global economy. According to the IPCC (2021), human-induced climate change has already increased global temperatures by approximately 1.1°C above pre-industrial levels.

2. Causes of Climate change:

2.1 Greenhouse Gas Emissions:

Carbondioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) all contribute negatively to the climate change.

2.2 Deforestation and Land use changes:

These activities reduce carbon sequestration.

2.3 Industrialization and Urbanization:

Releases pollutants and heat, contributing to global warming.

2.4 Agriculture and Livestock:

Methane from livestock, nitrous oxide from fertilizers are all negative contributors

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3. Key Hindrances in Resolving Climate change:

Climate change mitigation and adaptation face **multiple challenges**:

3.1 Economic Constraints:

Transitioning from fossil fuels to renewable energy requires **huge investment**. Owing to which, the developing countries often prioritize **economic growth** over environmental protection.

3.2 Political and Governance Issues:

Lack of **political will** or short-term focus undermines long-term climate policies. **Weak enforcement** of environmental laws in many countries is also a problem, alongside **global co-ordination gaps** prioritizes policies that are mostly national.

3.3 Technological and Infrastructure limitations:

Limited access to **clean technologies**, especially in developing countries. Similarly, renewable energy infrastructure and sustainable agriculture technologies require **time and expertise**.

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3.4 Social and cultural Barriers:

Low **public awareness** and resistance to behavior change (e.g: reducing energy consumption) and some traditional practices (deforestation and overgrazing) continue due to **socio-cultural norms.**

3.5 Conflicts and Security Issues:

The regions are affected by **conflict or political instability** thereby creating a struggle to implement climate policies. Climate adaptation may be undermined by **war, migration, and economic crises.**

3.6 Global Inequality:

Developed nations historically caused **most emissions** (like China), but developing countries (like Pakistan) face greater vulnerability.

4. CONCLUSION:

Climate change is a complex, multi-dimensional challenge that threatens ecosystems, human health, and global stability. While the science is clear, resolving it is hindered by **economic,**

(3) Date: / /

political, technological, social, and global megavalue issues. Effective mitigation requires global cooperation, strong governance, technology transfer, public awareness, and sustainable development policies.

QUESTION NO:-3

(A)

EUTROPHICATION:

1. INTRODUCTION:

Eutrophication is the most serious form of **water pollution**, affecting freshwater and marine ecosystems worldwide. It results from **excessive nutrient enrichment**, primarily **nitrogen (N)** and phosphorus **(P)**, leading to uncontrolled growth of algae and aquatic plants. If unchecked, eutrophication severely degrades **water quality**, disrupts aquatic life, and threatens human health.

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2. Definition of Eutrophication:

Eutrophication is the process by which a water body becomes **excessively enriched with nutrients**, particularly nitrates and phosphates, resulting in **algal blooms**, depletion of dissolved oxygen, and eventual degradation of aquatic ecosystems.

OECD (1982):

"Eutrophication is the enrichment of water by nutrients causing an accelerated growth of algae and higher forms of plant life"

3. Types of Eutrophication:

3.1 Natural Eutrophication:

This occurs slowly over centuries, results from natural nutrient inputs such as: **soil erosion, weathering of rocks,** and decomposition of **organic matter.** It is common in lakes as a part of **ecological succession.**

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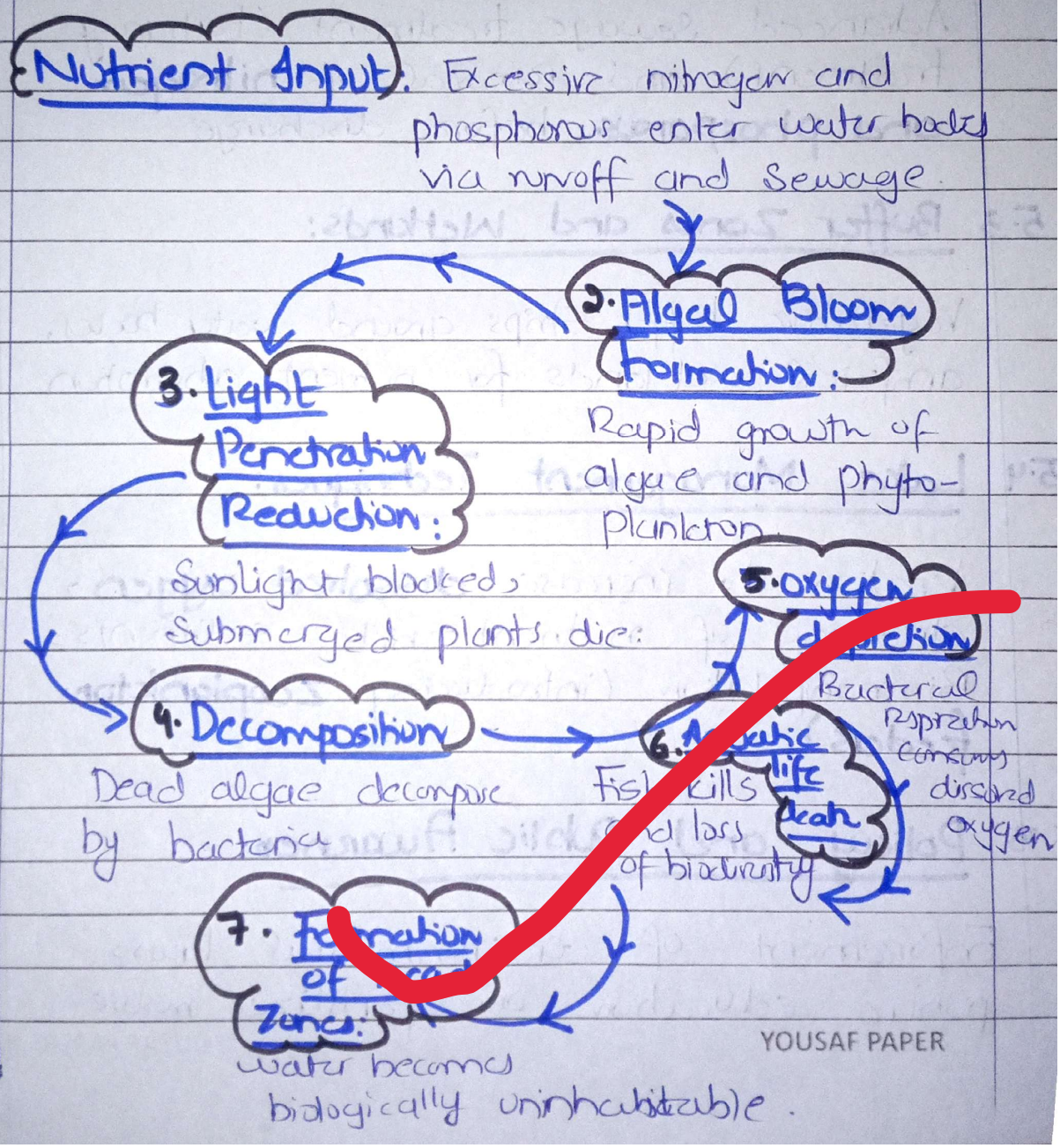
3.2 Cultural (Anthropogenic) Eutrophication.

It occurs rapidly due to human activities. The major sources are: **agricultural runoff** (fertilizers), sewage and waste-water discharge, and industrial effluents, its more destructive and widespread.

4. Process of Eutrophication:



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5. Control and Prevention Measures:

5.1 Nutrient Source Control:

Controled use of fertilizers, phosphate free detergents, and promotion of **organic farming practices.**

5.2 Wastewater Treatment:

Advanced sewage treatment (tertiary treatment) and removal of **nitrogen and phosporus** before discharge.

5.3 Buffer Zones and Wetlands:

Vegetative buffer strips around water bodies, artificial wetlands for nutrient absorption.

5.4 Lake Management Techniques:

Aeration to increase **dissolved oxygen**, dredging of nutrient-rich sediments, Biomanipulation (introducing **zooplankton feeders**)

5.5 Policy and Public Awarness:

Enforcement of environmental laws, public education on fertilizer misuse

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Integrated water Resource Management

6. CONCLUSION:

Eutrophication is a major environmental threat driven by human activities. While natural eutrophication is slow and inevitable, cultural eutrophication is rapid and preventable. Effective management requires nutrient control, source, improved wastewater treatment, ecosystem restoration, and strong governance. Sustainable water management is essential to protect aquatic ecosystems and human well-being.

PART - (B)

1. INTRODUCTION:

Global warming refers to the long term increase in Earth's average surface temperature, primarily due to enhanced greenhouse gas (GHG) emissions and indirectly, ozone layer depletion. Human activities since the Industrial Revolution have altered the atmospheric composition intensifying the natural greenhouse effect and disturbing atmospheric balance. While GHG emissions are the direct driver

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of global warming, ozone layer depletion plays an indirect but significant role in climate dynamics.

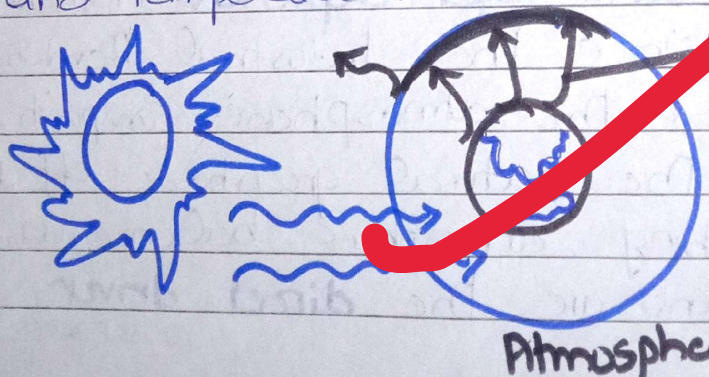
2. Emission of GHGs and Global Warming:

2.1 Major Greenhouse Gases:

- Carbon dioxide (CO_2): Fossil fuel combustion, deforestation
- Methane (CH_4): Agriculture, livestock, landfills
- Nitrous oxide (N_2O): Fertilizers, industrial processes
- Flourinated gases: (CFCs, HFCs): Refrigeration, aerosols

2.2 Mechanism:

Solar radiation enters Earth atmosphere, in return earth emits infrared radiations, GHGs absorb and re-radiate heat back to earth, thus, increased GHG concentration leads to more heat trapping and temperature rise.



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- Owing to the increase in GHG emissions, CO_2 concentration increased from 280 ppm (pre-industrial) to over 420 ppm.
- IPCC confirms that human-induced GHGs are the dominant cause of observed warming since the mid-20th century.

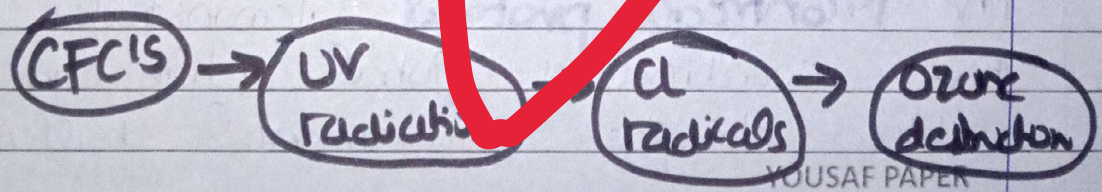
2.2 Ozone layer Depletion and Its Relation to Global warming:

2.2.1 Ozone layer Function:

It's located in the **stratosphere**, it absorbs harmful **UV-B radiation**, thus, it protects and regulates atmospheric temperature structure.

2.2.2 Causes of Ozone Depletion:

Emission of **CFCs, Halons, and HCFCs** cause ozone depletion, UV radiation breaks CFCs and releases chlorine atoms and this **chlorine destroys Ozone molecules** ($O_3 \rightarrow O_2$)



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2.3 **Relationship with Global warming:**

Indirect contribution:

Ozone depletion alters stratospheric temperatures, increases UV radiation reaching Earth's surface. Some ozone depleting substances (ODSs) like CFCs are also powerful GHGs. Climate change can slow ozone layer recovery by cooling the stratosphere. Ozone depletion **doesn't directly cause global warming** but interacts with climate systems and shares common pollutants.

3. CONCLUSION:

Global warming is primarily driven by the enhanced greenhouse effect due to **GHG emissions**, while ozone layer depletion plays a complementary and indirect role in this regard. Effective mitigation requires **reducing fossil fuels use, phasing out ozone-depleting substances, and strengthening international cooperation.** The success of the **Montreal protocol** demonstrates that coordinated global action can address atmospheric environmental challenges.

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QUESTION NO:- 7

(A)

1. INTRODUCTION:

Food security is one of the most critical challenges of the 21st century, intensified by **global warming and climate change**. Rising temperatures, altered rainfall patterns, and increased frequency of extreme weather events are directly undermining agricultural productivity, particularly in developing countries. Since agriculture is highly climate-sensitive, global warming poses serious threats to food availability, accessibility, and stability.

2. Definition of Food Insecurity:

According to the **Food and Agriculture organization (FAO)**:

"Food insecurity exists when people lack regular access to sufficient, safe, and nutritious

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food to maintain a healthy and active life"

Food insecurity has **four dimensions:**

1. Availability
2. Accessibility
3. Utilization
4. Stability

3. Threats to Agriculture Posed by Global Warming:

3.1 Rising Temperatures:

Heat stress reduce crop yields (e.g: wheat, rice, m...), this shortens crop growth and accelerates **evapotranspiration.**

3.2 Altered Rainfall Pattems:

Increased droughts and floods disrupt planting and harvesting cycles, erratic monsoons affect **rain-fed agriculture.**

3.3 Increased Frequency of Extreme Events:

Heatwaves, floods, and cyclones destroy crops and farmland. Soil erosion and nutrient loss reduce long-term productivity.

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3.4 Water Scarcity:

Melting glaciers and declining groundwater affect **irrigation**. There is a competition between agriculture, industry and domestic use.

3.5 Pest and Disease Proliferation:

warmer climates expand the range of insects and pathogens, thus, there is **increased crop loses** due to unfamiliar pests.

3.6 Soil Degradation:

Higher temperatures increases Soil Salinity and **desertification**. Organic matter decomposition accelerates, reducing fertility.

4. Measures to Address Food Insecurity and Climate Threats:

4.1 Climate - Smart Agriculture:

Heat and drought resistant crop varieties should be used and use of climate resistant seeds should be promoted. There should be crop **diversification** and **intercropping**.

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4.2 Efficient Water Management:

Drip and sprinkler irrigation systems should be used. There ought to be **rainwater harvesting** and **watershed management**.

4.3 Sustainable Land Management:

Conservation tillage and **organic farming**. Agroforestry to improve soil and microclimate.

3.4 Early Warning and Climate Information Systems:

There should be weather forecasting for **farmers**, disaster preparedness and crop insurance schemes.

4.5 Policy and Institutional Measures:

Investment in agricultural research and extension services, support should be provided to **smallholder farmers** and there should be integration of food security in climate policy.

5. CONCLUSION:

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Food insecurity is deeply intertwined with global warming, as climate induced [illegible] increasingly threaten agricultural systems. Rising temperatures, water scarcity, and extreme weather conditions undermine food production. Addressing this challenge requires **climate-resilient agriculture**, **sustainable resource management**, and **strong policy interventions** to ensure long-term food security in a warming world.

(B)

Environmental Impact Assessment (EIA)

1. INTRODUCTION:

Rapid industrialization and development projects often cause adverse environmental impacts if not properly assessed. EIA is a **preventive environmental management tool** designed to ensure that development is environmentally sustainable by identifying and mitigating potential negative impacts before **project implementation**.

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2. Definition of EIA:

EIA is a systematic process to identify, predict, evaluate, and mitigate the environmental, social and economic impacts of a proposed project prior to decision-making.

"EIA is a process of evaluating the likely environmental impacts of a proposed project before a decision is taken"

3. Process of EIA:

1. **Screening**: Determines whether a project requires EIA or Initial Environmental Examination (IEE)

2. **Scoping**: Identifies key environmental issues and impacts to be studied.

3. **Baseline Study**: Collection of data on existing environmental conditions (air, water, soil, biodiversity)

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4. **Impact Prediction and Evaluation:**

Assessment of potential positive and negative impacts.

5. **Mitigation Measures:**

Proposing actions to avoid, reduce or compensate impacts.

6. **EIA Report (EIS) Preparation:**

Documentation of findings and recommendations

7. **Review and Decision-Making:**

Competent authority evaluates EIA and grants approval or rejection.

8. **Monitoring and Follow-up:**

Ensures compliance during project implementation

4. **Benefits of EIA:**

1. Prevents environmental degradation.
2. Promotes **sustainable development**
3. Improves project design and planning.
4. Reduced long-term economic costs.

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3. Ensures legal and regulatory compliance
6. Encourages public participation and transparency.
7. Protects ecosystems and human health.

5. CONCLUSION:

EIA is a vital environmental management instrument that integrates environmental considerations into development planning. EIA helps achieve a balance between economic growth and environmental protection, making it essential for sustainable development.

QUESTION NO:-8

(A)

Agenda - 21

1. INTRODUCTION:

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Agenda 21 is a comprehensive **global action plan for sustainable development**, adapted at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, 1992 (Earth Summit). It provides a blueprint for governments, international organizations, and local authorities to achieve sustainable development in the 21st century by integrating **environmental protection with socio-economic development.**

2. Definition and Nature:

Agenda-21 is a **non-biding, voluntary framework** consisting of **40 chapters**, addressing environmental, economic, and social dimensions of sustainable development **at global, national, and local levels.**

3. Structure and Major Themes of Agenda-21:

Agenda-21 is organized into **four main sections:**

3.1 Social and Economic Dimensions:

Combating poverty, changing unsustainable

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consumption patterns, population dynamics and promoting health and human settlement sustainability.

3.2 Conservation and Management of Resources for Development:

protection of atmosphere, combating deforestation, sustainable agriculture and rural development, conservation of biodiversity and management of freshwater resources.

3.3 Strengthening the Role of Major Groups:

women, youth, indigenous people, NGOs, workers, farmers, and local authorities. Emphasis on public participation and inclusiveness.

3.4 Means of Implementation:

- Financial resources
- Technology transfer
- Capacity building
- Education, training and awareness

4. Significance of Agenda-21:

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→ First global framework linking environment and development.

→ Promoted the concept of Local Agenda 21, empowering local governments.

→ Influenced national environmental policies and sustainable development strategies.

→ Laid foundation for later frameworks like SDGs and Rio+20.

5. Limitations:

Non-binding nature limits enforceability, dependence on political will and financial resources, uneven implementation between developed and developing countries.

6. CONCLUSION:

Agenda 21 represents a landmark commitment towards sustainable development by emphasizing global cooperation. Despite implementation challenges, it remains a foundational document guiding international environmental governance and sustainable development policies.

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(B)

EUTROPHICATION:

INTRODUCTION:

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3. Types of Eutrophication

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This occurs slowly over centuries, results from natural nutrient inputs such as: **soil erosion, weathering of rocks,** and decomposition of **organic matter.** It is common in lakes as a part of **ecological succession.**

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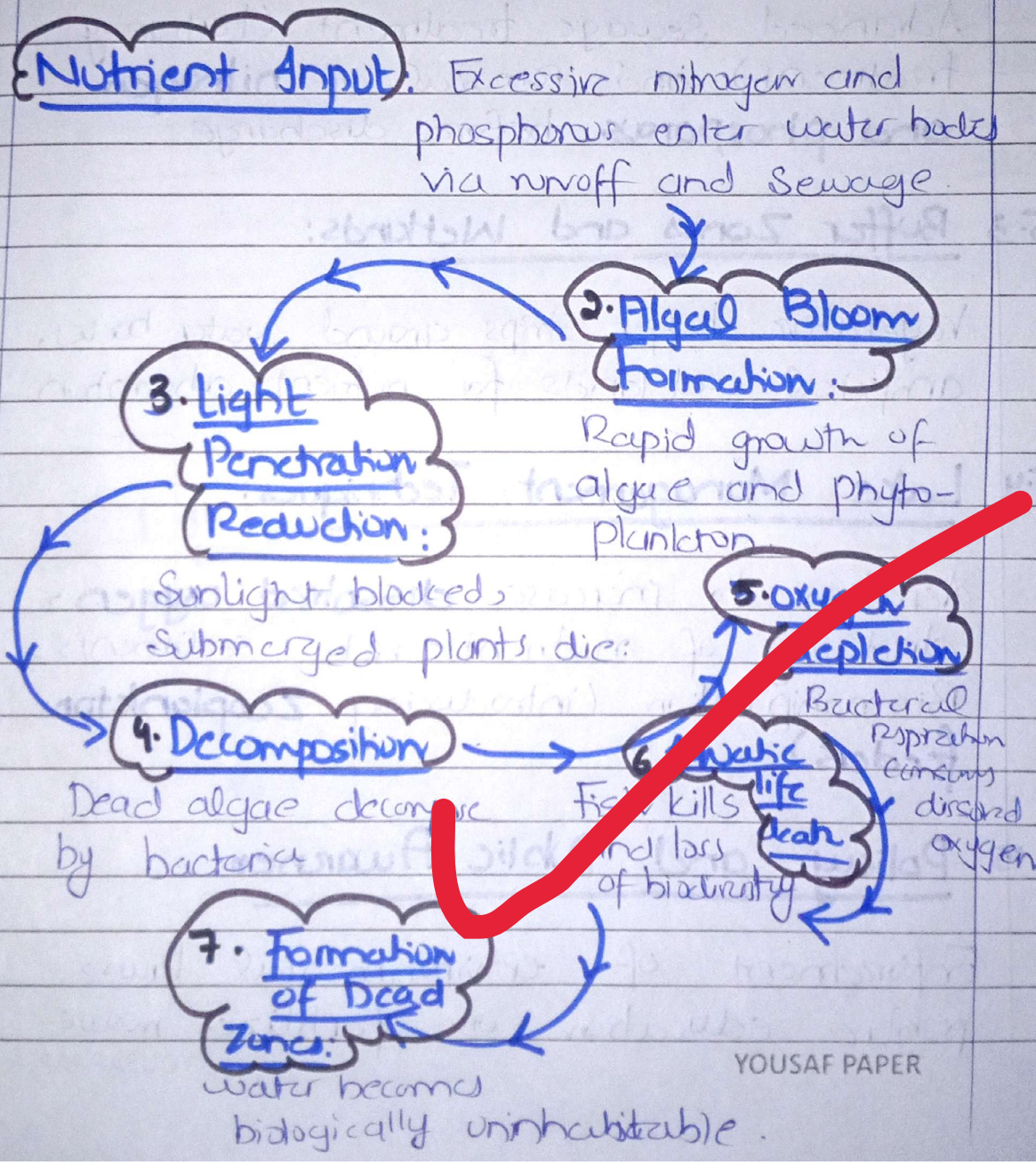
3.2 Cultural (Anthropogenic) Eutrophication.

It occurs rapidly due to human activities. The major sources are: **agricultural runoff** (fertilizers), sewage and wastewater discharge, and industrial effluents, its more destructive and widespread

4. Process of Eutrophication:



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5. Causes of Eutrophication:

1) Agricultural Runoff:

Excessive use of chemical fertilizers washes nitrates and phosphates into water bodies during rainfall.

2) Domestic Sewage Discharge:

untreated municipal wastewater rich in organic matter and phosphates

3) Industrial Effluents:

leads to release of nutrient-led waste

4) Detergents and Household Waste:

Phosphate based detergents significantly increase nutrient loads

5) Atmospheric Deposition:

Nitrogen oxides from vehicles and industries settle into water body through rainfall

6. Effects of Eutrophication:

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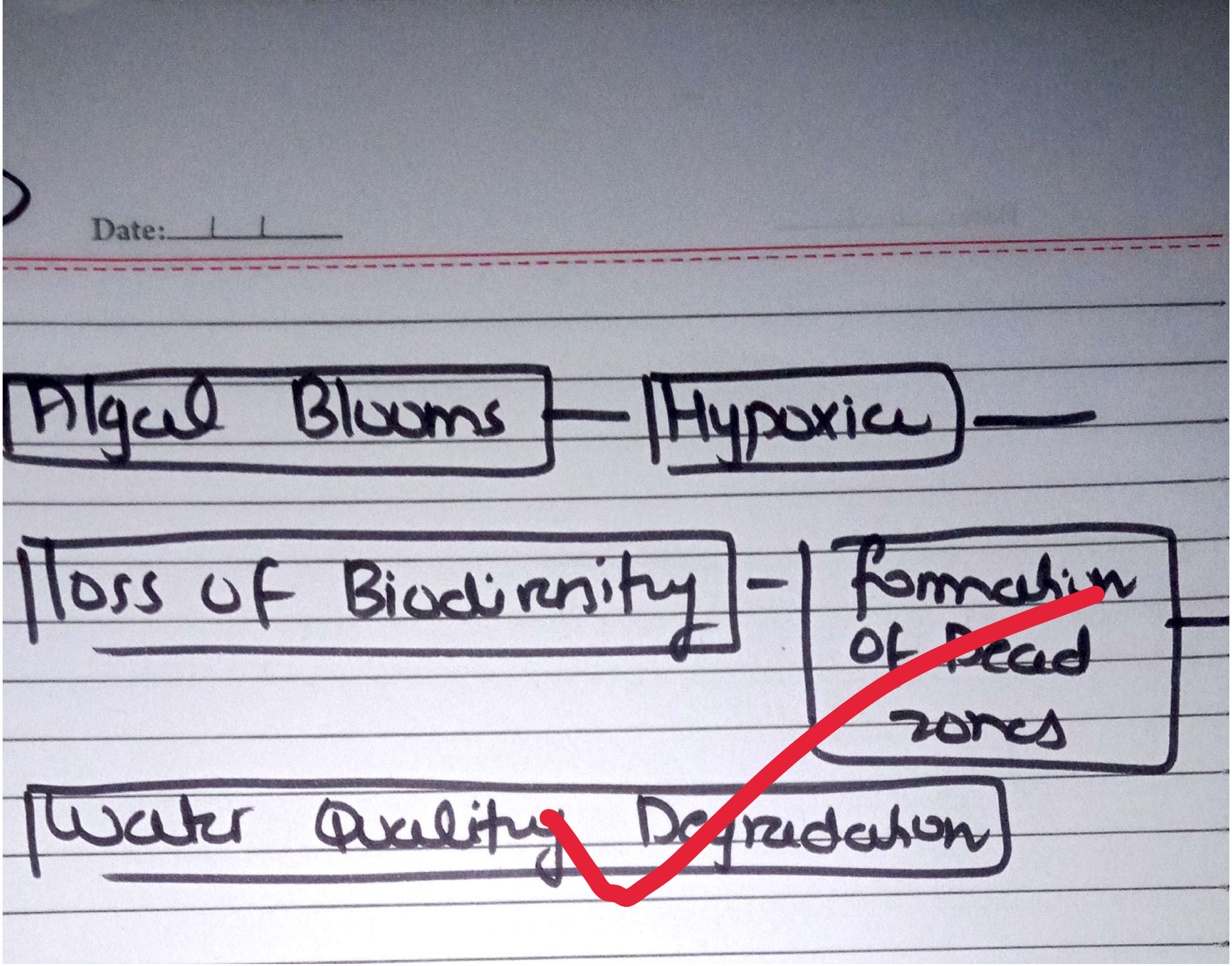

6. CONCLUSION:

Eutrophication is a major environmental threat driven by human activities. While natural eutrophication is slow and reversible, cultural eutrophication is rapid and preventable. Effective management requires nutrient control at source, improved wastewater treatment, ecosystem restoration, and strong governance. Sustainable water management is essential to protect aquatic ecosystems and human well-being.