

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.

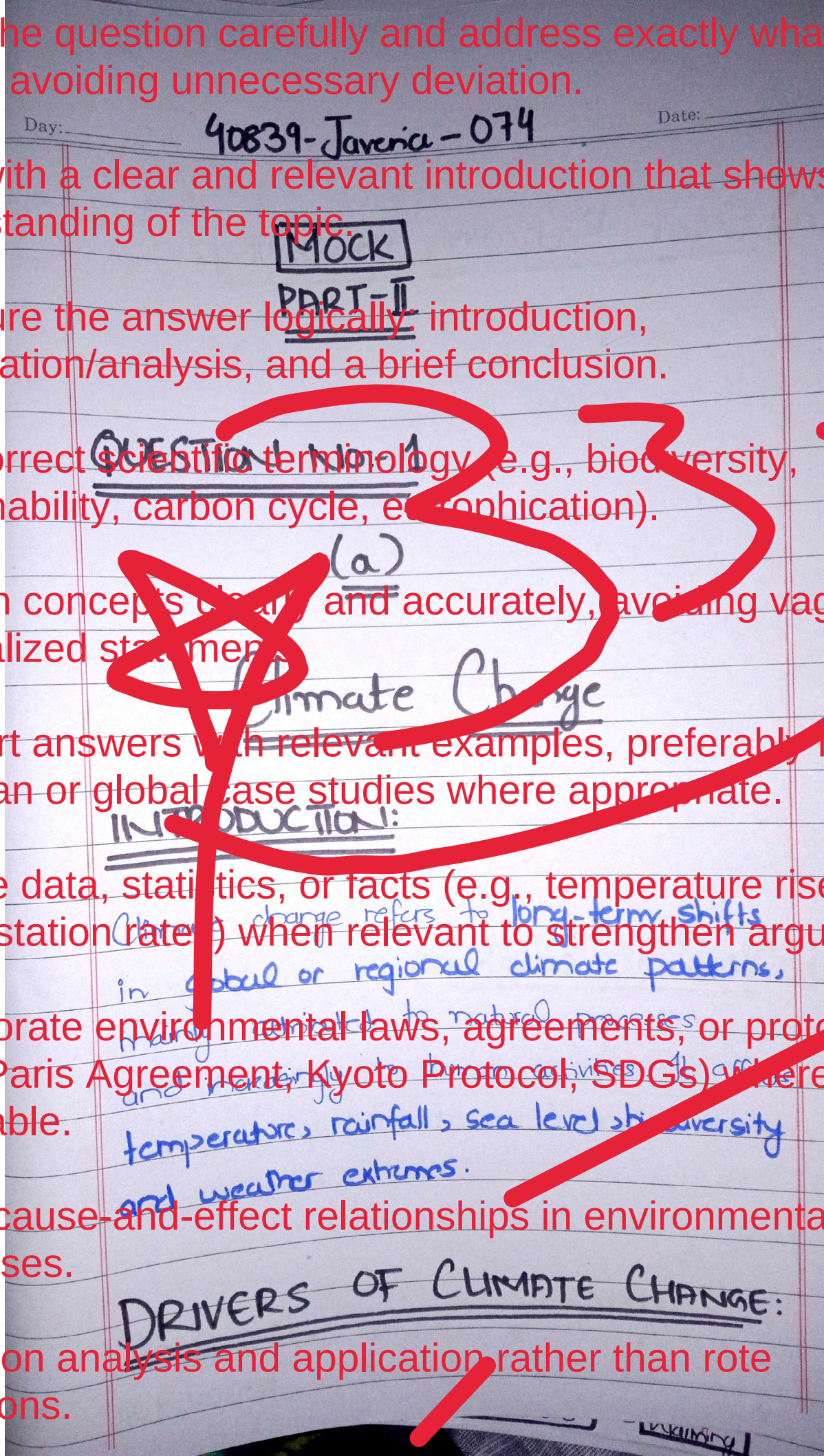
Include data, statistics, or facts (e.g., temperature rise, deforestation rate) when relevant to strengthen arguments.

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

Show cause-and-effect relationships in environmental processes.

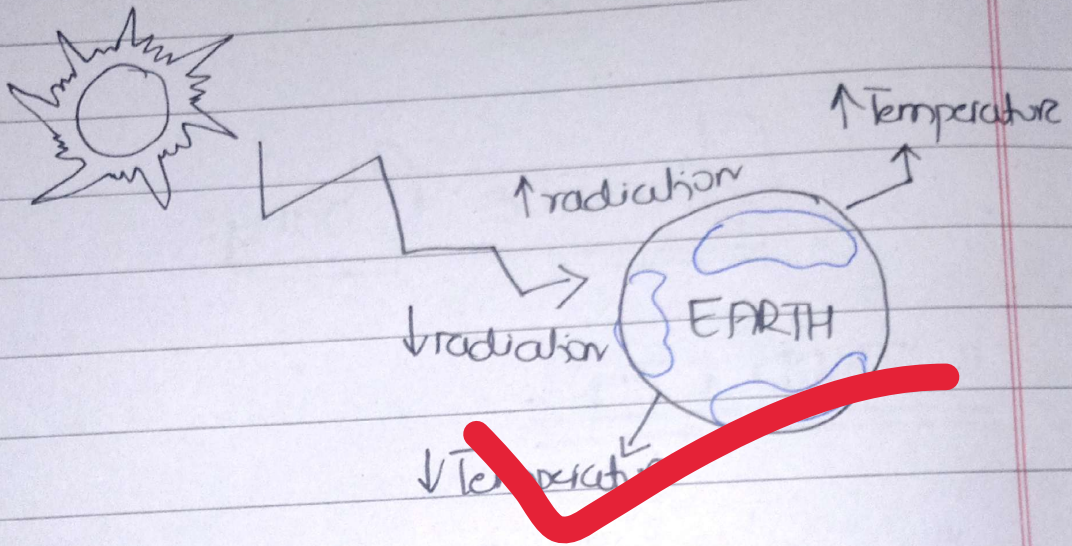
Focus on analysis and application rather than rote definitions.

Present balanced views by mentioning impacts,



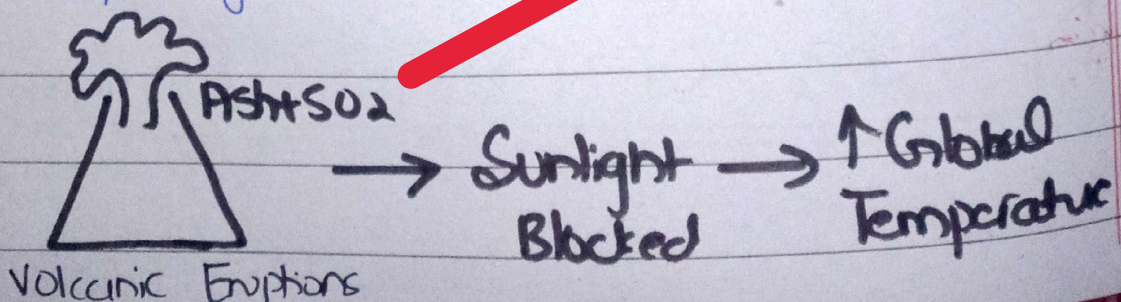
(a) Solar Radiation Variability:

The Sun's energy output fluctuates in 11-year cycles. When solar radiation increases, Earth warms slightly, when it decreases, Earth cools.



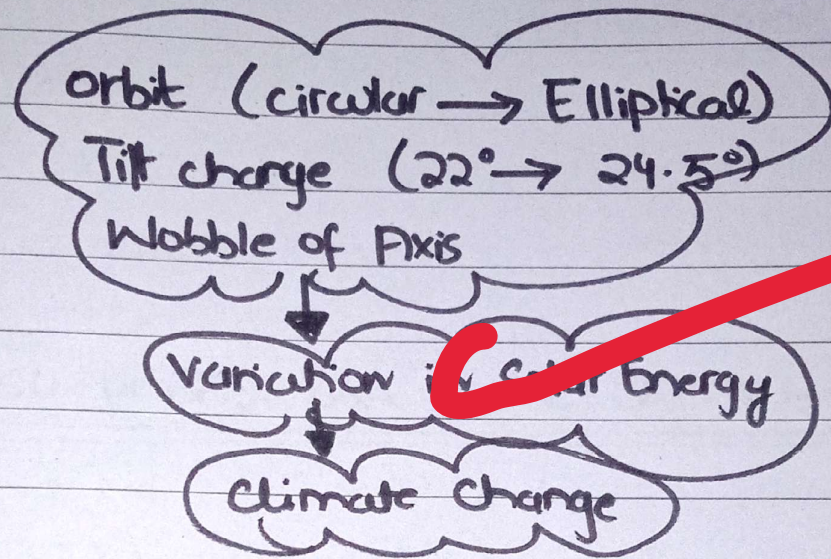
(b) Volcanic eruptions:

Major eruptions release ash and sulfur-dioxide into the stratosphere, forming aerosols that reflect sunlight and temporarily cool the planet.



(c) Milankovitch cycles:

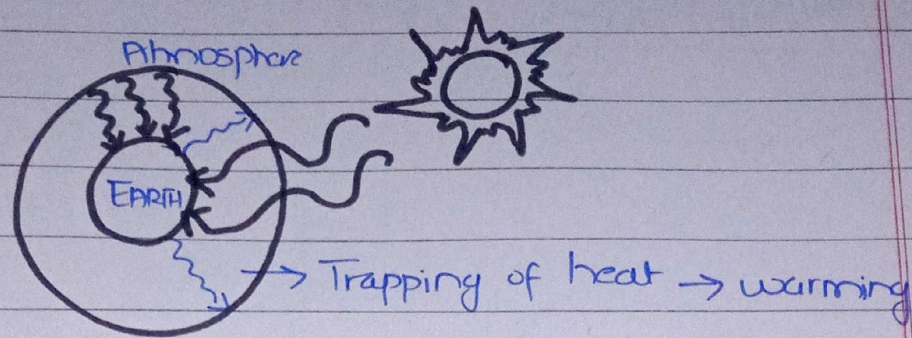
Changes in Earth's orbital shape (Eccentricity) > tilt > and axial wobble alter how solar energy is distributed, leading to long-term climate shifts such as ice ages.



II Anthropogenic (Human-Induced) Drivers:

(a) Greenhouse Gases (GHG) Emissions:

Burning fossil fuels (coal, oil, gas), transport, power generation, and industries release large amounts of CO_2 , CH_4 , and N_2O . These gases trap outgoing heat.



(b) Deforestation:

Cleaning forests for agriculture and urbanization reduces CO_2 absorption, "carbon sinks" and releases stored carbon.

(c) Industrialization and Energy Use:

Factories and power plants emit large quantities of **GHGs and aerosols**.

Urban areas also generate heat islands due to asphalt and concrete absorbing more heat.

(d) Agriculture:

Livestock emit methane, Rice paddies emit methane, Fertilizers release nitrous oxide (N_2O). Together, these enhance warming.

(c) Land use changes:

Urbanization increases surface temperatures, while soil degradation reduces natural carbon storage.

(II) Process of Climate change:

(a) Natural Greenhouse effect:

A small amount of heat is trapped by GHGs (CO_2 , CH_4 , water vapour), keeping Earth warm enough for light.

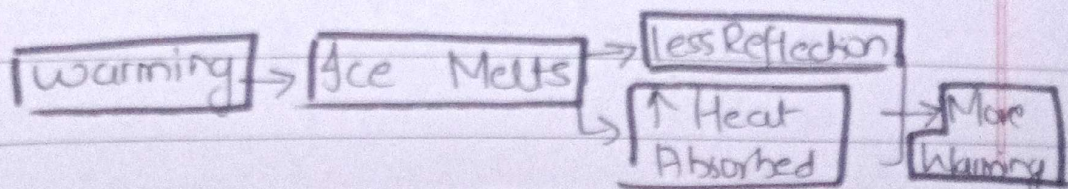
(b) Enhanced Greenhouse effect (Human-made):

Due to excessive GHG emissions, more heat gets trapped, causing global warming.

(c) Feedback Mechanisms:

• Positive feedback:

Amplifies warming, Ice-Albedo Feedback



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- Negative Feedback:

Stabilizes warming

- Example:

More CO₂ can increase plant growth (carbon fertilization) which absorbs some carbon from the Atmosphere.

- (d) Climate System Response:

As warming continues, several impacts occur:

- Rising Global Temperature
- Glacial retreats and sea-level rise
- Ocean acidification
- Extreme weather events (heatwaves, floods)
- Habitat loss and species migration

These changes further influence atmospheric and oceanic systems.

CONCLUSION:

Climate change arises from a combination of natural processes and human activities, but rapid warming today is primarily

anthropogenic. It is fundamentally important to design strategies such as renewable energy adoption, afforestation and sustainable land use planning.

(b) National Environmental Policy (NEP)

INTRODUCTION:

The National Environmental policy is a framework adopted by the government to ensure sustainable development by integrating environmental protection into all sectors of development. It seeks to balance economic growth with the conservation of natural resources and environmental quality for present and future generations.

SALIENT FEATURES OF NEP:

1. Sustainable development:

Balances economic growth with environmental protection.

(2) pollution control:

Prevents air, water and soil pollution through regulations and cleaner technologies.

(3) Conservation of Natural Resources:

Promotes sustainable use of forests, water, minerals, and biodiversity.

(4) Environmental Education and Awareness:

Integrates environmental education and raises public awareness.

(5) public participation:

Encourages community involvement in environmental decision making.

(6) Integration with Sectoral policies:

Ensures environmental considerations in industry, agriculture, energy, and urban

planning.

(7) Legislative framework:

Provides basis for laws, standards, and monitoring mechanisms.

(8) Precautionary and polluter pays principles:

Prevents environmental damage and holds polluters accountable.

(9) Promotion of Research and Technology:

Supports environmental research and adoption of green technologies.

(10) International Cooperation:

Aligns with global environmental agreements and climate initiatives.

CONCLUSION:

NEP provides a roadmap for sustainable development, ensuring environmental protection, public participation, and adherence

to legal and international standards, thereby safeguarding ecological balance for future generations.

QUESTION NO:-2

(a)

EUTROPHICATION

Eutrophication is the excessive enrichment of water bodies with nutrients, mainly nitrogen and phosphorous, which leads to overgrowth of algae and aquatic plants. It disrupts the natural balance of aquatic ecosystems, affecting water quality and biodiversity.

Causes of Eutrophication:

1. Agricultural Runoff.

Excessive fertilizers containing nitrates and phosphates enter rivers, lakes, and

ponds.

(2) Domestic Sewage:

Untreated or partially treated wastewater adds nutrients to water bodies.

(3) Industrial Effluents:

Food processing and chemical industries discharge nutrient-rich waste.

(4) Deforestation and Soil Erosion:

Nutrients from soil and runoff accumulate in water bodies.

(5) Atmospheric Deposition:

Nitrogen compounds from air pollution settle into water bodies.

Effects of Eutrophication:

(1) Algal blooms:

Rapid growth of algae reduces sunlight penetration, affecting aquatic plants.

(2) Oxygen Depletion:

Decomposition of algae consumes dissolved oxygen, leading to hypoxia.

(3) Death of Aquatic life:

Fish and other organisms die due to low oxygen levels.

(4) Loss of Biodiversity:

Sensitive species are eliminated reducing ecological diversity.

(5) Water quality deterioration:

produces foul smell, toxic substances, and affects potable water.

(6) Economic Impact:

Affects fisheries, tourism, and water treatment costs.

Measures to Control Eutrophication:

(a) Efficient wastewater Treatment:

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Treat domestic and industrial sewage before discharge.

(2) Controlled use of Fertilizers:

Promote organic farming and minimize chemical fertilizers.

(3) Buffer zones:

Plant vegetation along riverbanks to filter runoff.

(4) Afforestation and Soil Conservation:

Reduce soil erosion and nutrient runoff.

(5) Aeration of Water bodies:

Increase dissolved oxygen levels in lakes and ponds.

(6) Public awareness:

Educate community about proper waste disposal and nutrient management.

(7) Regulations and policies:

Implement environmental laws to control

nutrient pollution.

CONCLUSION:

Eutrophication is a serious environmental problem caused by nutrient over-enrichment leading to oxygen depletion, loss of aquatic life, and deteriorating water quality. Integrated management involves prevention, treatment, and awareness to protect aquatic ecosystems.

(b)

Ramsar Convention

The Ramsar convention of wetlands is an International Treaty adopted in 1971 in Ramsar, Iran aimed at the conservation and sustainable use of wetlands worldwide. It recognizes the ecological, economic, cultural, and scientific importance of wetlands and seeks to prevent their degradation.

Objectives:

1. Conservation of Wetlands:
protect wetlands of international importance.
2. Sustainable use:
promote wise use of wetland resources for humans and wildlife.
3. International cooperation:
Facilitate cooperation among countries for wetland protection.

Key Features:

1. Designation of Wetlands:
Member countries identify and designate wetlands of international importance (Ramsar Sites)
2. Biodiversity protection:
Safeguards habitats for migratory birds and aquatic species.

3. Policy Integration:

Encourages integrating wetland conservation into national development planning.

4. Research and Monitoring:

Promotes scientific studies and monitoring of wetland ecosystems.

Importance:

- Maintains ecological balance and water purification
- Supports fisheries, agriculture, and livelihoods
- Provides habitat for migratory birds and endangered species.
- Helps in flood control and groundwater recharge.

CONCLUSION:

The Ramsar convention is a cornerstone of global wetland conservation, encouraging countries to manage wetlands sustainably, conserve biodiversity, and recognize their socio-economic value.

QUESTION NO:-5

(a)

National Sanitation Policy of Pakistan

Pakistan's National Sanitation Policy (NSP) 2006 aims to ensure **safe sanitation for all**, improve public health, protect the environment, and promote hygienic practices. It provides a national framework to manage wastewater, solid waste, and drainage systems in an integrated and sustainable manner.

Salient Features:

(1) Universal Access to Sanitation:

The policy aims to provide **safe, hygienic, and affordable sanitation facilities** to all citizens, particularly underserved rural and peri-urban areas.

(2) Emphasis on Hygiene Promotion:

A key feature is creating awareness about handwashing, safe water handling, and environmental hygiene to reduce disease burden.

(3) Community Led Total Sanitation (CLTS):

Encourages community participation in planning, implementation, and maintenance of sanitation systems, promoting ownership and sustainability.

(4) Integrated waste management:

Highlights proper management of:
Solid waste, Liquid waste, Industrial effluents, Hospital waste to reduce pollution and health risk.

(5) Safe Disposal Systems:

promotes construction of low cost toilets, improved sewerage systems, septic tanks, and safe disposal of

wastewater to avoid contamination of soil and water.

(b) School Sanitation Programs:

Focuses on providing separate sanitation facilities for boys and girls, coupled with hygiene education in schools.

(c) Institutional Strengthening:

Strengthens local governments, public health departments, and sanitation units for effective planning, regulation, and service delivery.

(d) Public-private partnerships (PPP):

Encourages private sector involvement in sanitation services, waste recycling, and infrastructure development.

(e) Gender and equity Considerations:

Ensures women's participation in sanitation planning and promotes equitable access for vulnerable groups.

(1b) Monitoring and Evaluation Frameworks

Establishes a mechanism for regular monitoring of sanitation services and progress toward national targets.

CONCLUSION:

Pakistan's National Sanitation Policy provides a comprehensive roadmap for improving sanitation, public health, and environmental quality. Through community participation, integrated waste management, institutional reform, and hygiene promotion, the policy aims to create a clean, healthy, and sustainable environment.

(b)

EIA

Environmental Impact Assessment is a systemic process used to evaluate the environmental consequences of

a proposed project before it is approved or implemented. Its purpose is to ensure sustainable development by predicting impacts, proposing mitigation measures, and involving public participation.

Process of EIA:

① Screening:

Determines whether a project requires a full EIA based on size, type, or location.

② Scoping:

Identifies key environmental issues, potential impacts, and the scope of investigation.

Terms of Reference are defined.

③ Baseline Study:

Assessment of existing key environmental conditions - air, water, soil, biodiversity, noise, and socio-economic condition.

④ Impact prediction and Analysis:

predicts and evaluates potential positive and negative impacts of the project during construction and operation.

(5) Mitigation Measures:

proposes strategies to avoid, reduce, or compensate for adverse impacts.

(6) Preparation of EIA report:

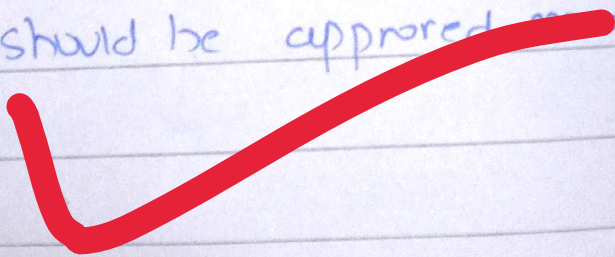
compiles findings into an Environmental Impact Statement (EIS) for review.

(7) Public Consultation:

Engages stakeholders and affected communities for feedback.

(8) Review and Decision-making:

Environmental authorities evaluate the EIA report and decide whether the project should be approved, modified or rejected.



(9) Monitoring and Compliance:

post-approval monitoring ensures

adherence to mitigation measures and environmental standards.

EIA

SEA

Level of Application

(1) project levels (dams, roads, industries)

policy, plan, and program level (energy policy, urban planning)

Timing

(2) Conducted after project formulation

Conducted before policies/plans are finalized

Scope

(3) Narrow, site specific impacts

Broader cumulative, regional impacts

Focus

(4) Technical and operational impacts

Sustainability, long-term strategic impacts

Decision making

(5) Supports decisions on single projects

Influences high-level planning and national strategies

Participation

Limited to project area

wider stakeholder engagement, national

CONCLUSION:

EIA is a vital tool for predicting and managing environmental impacts at the project level, ensuring development doesn't compromise ecosystems. Together, EIA and SEA can support sustainable development and environmental protection.

QUESTION NO:-6

(a) population Explosion

population explosion refers to a rapid and uncontrolled increase in human population, exceeding the carrying capacity of the environment. In many developing countries, the growth is driven by high birth rates, reduced mortality due to medical advancements, and lack of family planning. Its consequences include pressure on natural resources, deforestation, increased waste generation,

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unemployment, urban congestion and strain on education and health systems. It accelerates environmental degradation, land encroachment, water scarcity and increased carbon emissions. Addressing population explosion requires awareness campaigns, female education, access to reproductive health services, and economic development and national policies promoting sustainable demographic growth.

(b)

Food Insecurity

Food Insecurity occurs when people lack reliable access to safe, sufficient, and nutritious food for an active and healthy life. Causes include: poverty, climate change, declining agricultural productivity, soil degradation, water scarcity, rising population, and poor food distribution systems. In Pakistan, natural calamities have produced catastrophic effect leading

to inflation, ineffective storage facilities and dependence on a few staple crops. Consequences include malnutrition, stunted growth in children, diseases, economic instability and social unrest. Solutions involve sustainable agriculture, improved irrigation, climate-resilient crops, food storage facilities, price stability, poverty reduction programs and strengthening national food security policies.

(c) water logging and Salinity

Water logging occurs when excessive irrigation or poor drainage raises the water table close to the surface, saturating soil pores. Salinity results when salts accumulate in soil, often due to evaporation of standing water and inadequate leaching. Causes include: canal seepage, flat topography, over-irrigation, lack of drainage systems, and use of saline groundwater. Effects include:

reduced soil fertility, crop failures, land abandonment and decline in agricultural productivity. Control measures include: tile drainage, proper irrigation scheduling, plantation of salt-tolerant species, laser land leveling, gypsum application and installation of tube-wells for water table control.

(d) Cartagena protocol

The Cartagena protocol is an international agreement adopted in 2000, aimed at regulating the transboundary movement of living modified organisms (LMOs) resulting from biotechnology. Its main objective is to ensure that LMOs do not cause harm to biodiversity, ecosystems or human health. Key features include: Advanced Informed Agreement (AIA) procedure; requiring exporters to notify and seek permission from importing countries before transferring LMOs. It emphasizes precautionary principle, risk assessment, capacity building

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for developing states and establishing
Biosafety clearing house (BCH) for
information sharing thus strengthening
global efforts to manage biotechnology
responsibly and safeguard environmental
and public health.

