Impressive if you completed the paper in allotted 3 hours.

46

3a)

i) Introduction:

The 21st century is witnessing a swift progress and advancement in technological developments these developments have made day to day lives easy and comfortable. However, despite having numerous benefits, these advancements are actually plaguing climate, and inturn inducing a dire impact on natural and societal systems.

ii) Impacts of Technological Developments on Climate change:

As aforementioned technological developments are exacerbating climate change which then causes a plethora of ramifications. To enumerate how techology is affecting climate change is as follows:

General Instructions

1. Give numbering to headings.
2. Do not write lengthy paragraphs. Write medium sized paragraphs with headings.
3. Do not use table for comparison and contrast questions.
4. Draw figures/diagram/flowchart where needed.
5. Start new question from fresh page.
6. Avoid writing wrong references.
7. Give more weightage to expressedly asked part/s of the question.
8. Change colour scheme for references to give them more visibility.
9. Manage time well.
10. Wide page borders are discouraged. Should be reasonable.

Maxim

Day / Date

2.1) Increased Energy Demand:

The Industrial revolution and the subsequent development in the domain of technology have soared energy demand. And, despite the word's endeavours to transition to renewable energy, the axion remains that such high demand of energy cannot be, atleast in the near future, met with renewable energy resources. As a corollary, Fossil fuels are used to fulfill the energy demands, which, inturn precipitate climate change.

2.2) Transport Emissions:

The tecnological developments have proliferated vehicle use amongst the populace. This, albeit has made life easy by shortening time to travel distance, but has prompted a surge in emissions of green house gases such as carbon dioxide. This eventually leads to climate change.

Maxim

Day / Date

2.3) Deforestation:

Culting down trees for wood is an ancient practice, followed by generations. The archaic method of cutting trees down was slow and gave enough time to the ecosystem to recover. Technological developments have furnished man-kind with cutting-edge machinery that can expedite the process and cause massive deforestation.

2.4) Waste Generation:

Proliferation of technology have increased the consumption patterns resulting in excessive waste generation. While societies are equipped with mechanisms to manage this waste, many methods to dispose of waste, such as incineration or landfills, can generate CO_2 emmissions which can precipitate climate change.

2.5) Industrial Processes:

Industrial processes harm and

Maxim

Day / Date

aggravate climate change in many ways. One of these is the use of chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) in manufacturing many electronic applications such as refrigerators. The CFCs and HCFCs, when emmitted, can have severe impacts on climate change.

3) Impacts of climate change on Natural and societal systems

3.1) Impacts on Natural Systems:

3.1.1) Rising Temperatures:

The global temperature is rising, and this can have dire impacts. This is evident from the severe heat waves that the world is experiencing. IPCC indicates that the world temperature has risen 1.1℃ since 1850-1900, and is likely to increase to 1.5℃ in the next 20 years.

3.1.2) Sea level Rise:

Maxim

Day / Date

There is also an drastic rise in sea water levels. This is likely due to the thermal expansion of water and excessive melting of glaciers. The IPCC observes that the sea levels are likely to rise between 0.45 feet to 3.61 feet by the end of the century.

3.1.3) Extreme Weather Conditions :

The world is witnessing severe weather conditions. Whether its heat waves or record breaking temperature drops, there is certainly some unprecedented weather changes. On top of this there has been a proliferation in natural weather related disasters such as floods etc.

3.1.4) Biodiversity loss :

The Biodiversity is also impacted due to climate chang. Certain species, amphibions in particular, cannot survive in protracted and intense heat waves, as a result many different species have died or are on the

Maxim.....

Day / Date

verge of extinction.

3.2) Impacts on Societal Systems:

3.2.1) Food Security:

Climate extremes coupled with altered precipitation have negative consequences on agricultural activities. Many crops cannot survive such conditions which eventually leads to low crop yield, inducing food shortages.

3.2.2) Water Scarcity:

Protracted high temperatures can result is excessive evaporation in water bodies. This leaves only a modicum water for drinking and other industrial and agricultural purposes.

3.3.3) Infrastructure Vulnerability:

As aforementioned, climate change can proliferate natural weather related disasters such as floods, hurricanes. When Infrastructure is exposed to

Maxim

Day / Date

such clamaties, it is susceptible to heavy losses.

3.3.4) Health Crisis:

Extreme weather conditions coupled with natural disasters can give rise to many viruses and diseases.

Example:

In 2022, Pakistan was engulfed with massive floods that covered more than 1/3 of the country. This was followed by a deadly wave of viruses and diseases, such as malaria, typhoid, that grappled the country.

3.3.5) Economic Impact:

Severe weather conditions not only hinder crop yeild but trammel many industrial process es well. This could have dive ramification on the economic generation capacity of a region.

Maxim

Day / Date

4) Possible Adaptations to Climate Change:

4.1) Stabalizing levels of Green House Gases:

Green House Gases are the paramount source of climate change, leaving severe reprecussions wherever they are emitted. By tackling the power at source will ensure low levels of GHG's in atmosphere.

4.2) Transforming Energy Sector:

Buring fossil fuels for energy is another significant challenge to climate change. Since the world, cotemporarily, does not have the capacity to generate adequate renewable energy to supersede burning fossil fuels, they have to resort to such archaic means. However, with the passage of time, countries can amplify their renewable energy sources and end their dependency on fossil fuels.

4.3) Increase Forest Cover:

Trees have the natured ability to store CO_2, the most significant

Maxim

Day / Date

contributor to green house effect. With increasing forest cover it could be ensured that CO_2 levels in the atmosphere are decreased.

4) Resilient Infrastructure:

Since natural disasters cannot be prevented from occuring, It is better to build infrastructure that can withstand such clamities. Such resilient infrastructure will minimize the damage induced.

5) Conclusion:

In a nutshell, technological advancements can precipitate climate change which in turn can have dire consequences on natural and societal systems. Albeit, technological developments cannot be halted, there are measures and policies that can be adopted to ameliorate the crisis. The solutions embodied in the answer have the potential to reduce the negative impacts of climate change.

Add flowchart.

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3b)

1) Introduction:

Solid waste refers to any non-liquid waste materials that are discarded by individuals businesses, industries and institutions. It includes a wide range of materials generated from various activities and processes. Solid waste management is the process of manging this waste.

2) Process of Solid Waste Management (SWM):

SWM process comprises of 6 functional elements which are as follows:

Waste Generation: Solid waste is generated from various sources.

On-Site Handling: This step involve collecting the waste from various locations.

On-Site Processing: During the collection phase, the waste is first segregated and then placed

Maxim

Day / Date

in appropriate containers according to the type of waste i.e Recyclable.

Waste Transportation: waste is then transported from the collection point to treatment facilities or disposal sites.

Treatment: Some waste has to be treated first, due to its hazardous nature, before it can be safely disposed.

Disposal: Non-Recyclable waste & non-recoverable waste can be disposed of through various methods.

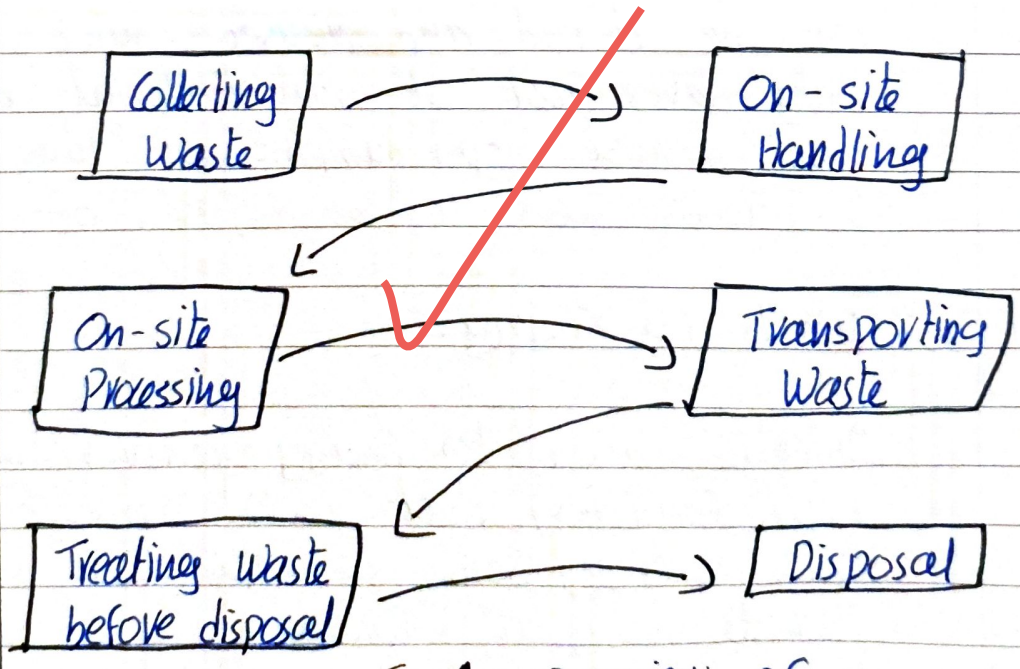

Fig 1: Overview of SWM Process

Maxim

Day / Date

3) Opportunities Regarding the Solid Waste Management :

3.1) Source Reduction :

This involves minimising the use of packaging materials, especially non-recyclable materials such as plastic wraps. This not only results in less waste gevation but also limits land fills or open dumping.

3.2) Recycling :

This encompasses promoting use of recyclable materials. This means the same materials can be cleaned and reused, which not only saves cost of raw material but also decreases open dumping or land fills since less waste needs to be disposed of.

3.3) Waste to Energy :

Introduce waste to Energy converting methods or facilities, that can convert waste into energy, some examples of such methods as as follows:

Maxim

Day / Date

3·3·1) Incineration :

The waste is incinerated which generates heat. This heat is then used to spin turbines which can generate electricity.

3·3·2) Pyrolysis :

This is ~~use~~ the thermal decomposition of waste materials in the absence of oxygen. It produces a mixture of gases, liquids (bio-oil, and char, which can be used as fuel.

3·4) Public Awareness :

Meticulous campaigns should disseminate the issue of solid waste and how ~~genal~~ general populace can do their part in allieviating the issue, namely by ~~seperating~~ recyclable material from non recyclable material when disposing waste. This step could go a long way in assisting the process as less time and effort would be exerted to do this by waste management staff.

Maxim

Day / Date

3.5) Composting:

Composting is a process that involves processing organic waste into nutrient-rich compost. that can be used to enrich the soil. Promoting composting facilities would not only prevent soil degradation but att also assist SWM process by reducing land fill waste.

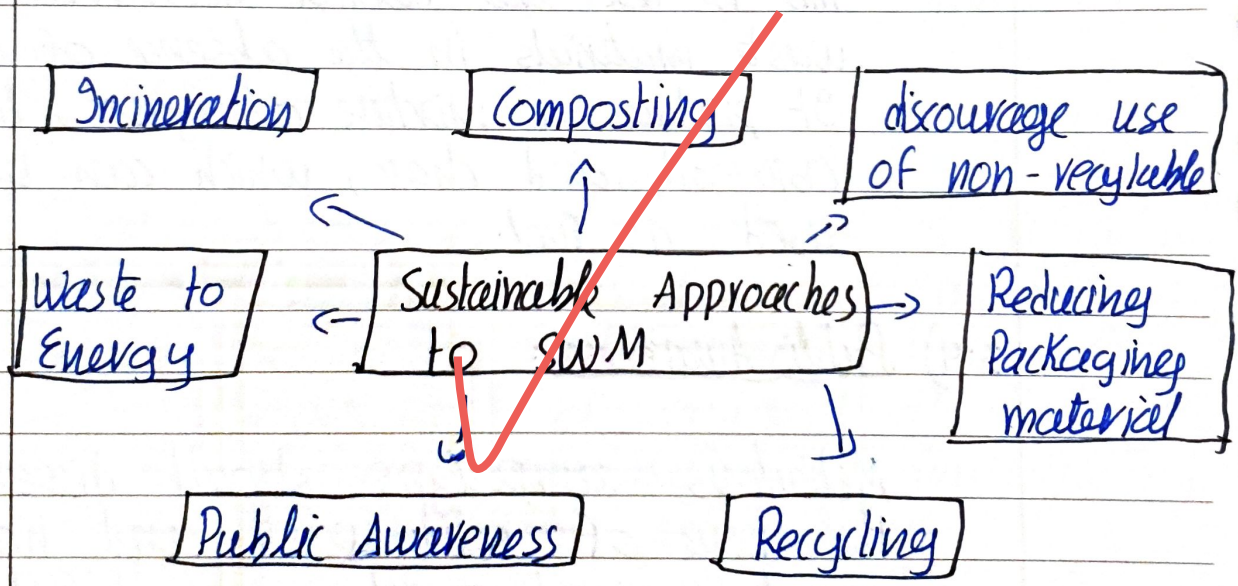

Fig 2: overview of Sustainable Approaches

4) Challenges to the Solid Waste Management System of Pakistan

Maxim

Day / Date

4.1) Inadequate Infrastructure:

Pakistan does not have adequate resources to manage waste effectively. The scarcity of resources pose a massive impediment to a well organised waste management system that can operate on a widescale area.

4.2) Huge Amount of Waste Generated:

Another significant challenge is the ~~enormous~~ sizable waste produced in Pakistan. The International Trade organisation indicates that the city of Karachi, alone, produces 10500 ton of waste daily.

4.3) Limited Recycling:

Only a modicum of recyclable material is used in Pakistan. Furthermore, even the recyclable material is not recycled. This not only increases the demand of raw materials but also leads

Maxim

Day / Date

more landfill waste.

4.4) Informal Sector manages Waste:

Much of the waste in Pakistan is managed by the informal sector. This means they operate outside the formal, regulated framework or government law and regulations, rendering it ineffective.

4.5) Lack of Awareness:

Most people are unaware about recycling and proper disposal practices. ~~This~~ Hence, recycling bins are not properly used, and recyclable and non recyclable materials are not distinguished before disposing. This contributes to the ineffective waste management system.

4.6) Inadequate Resources:

Many cities are not supplied with essential resources for an efficient waste management system. Many public areas are not even equipped with dustbins, let alone different recycling bins to dispose waste according to its type, hence, most of the waste

Maxim

Day / Date

is discarded in efficiently, making waste management difficult.

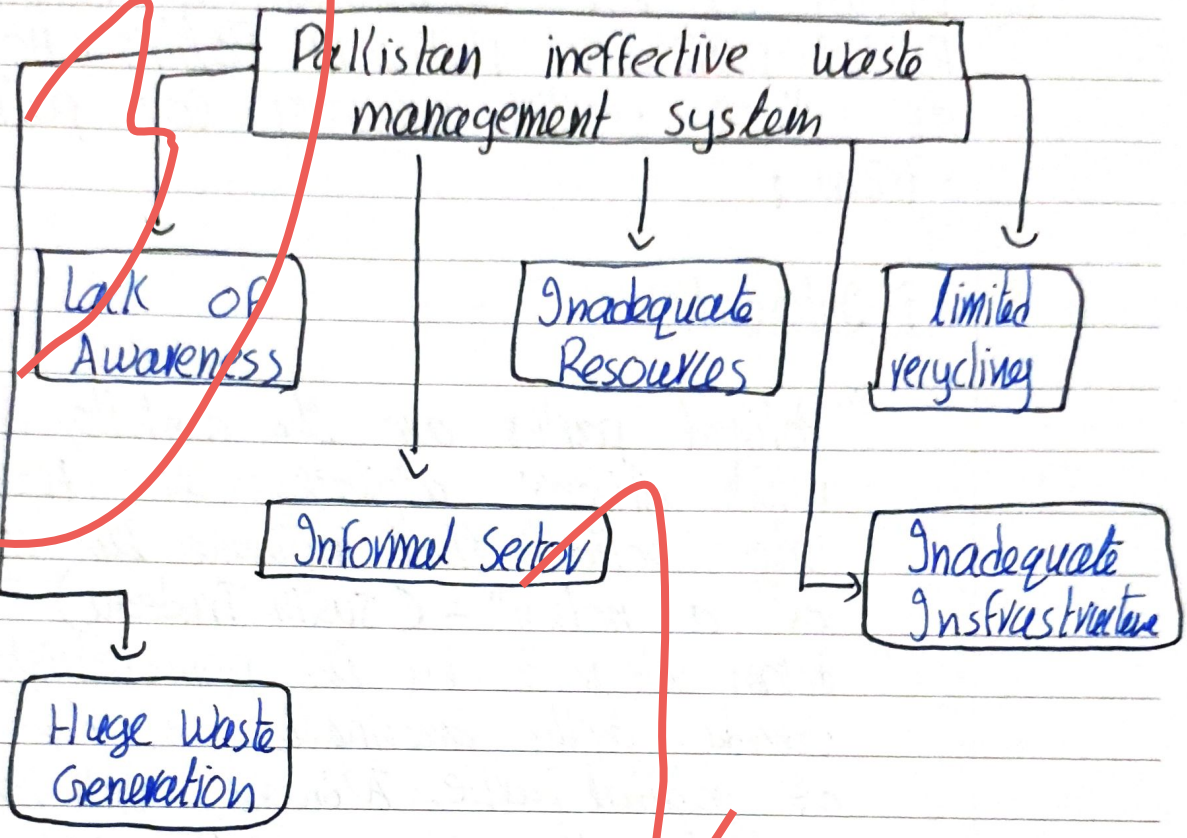

Fig 3: Pakistan's weak SWM system

5) Conclusion:

Waste management system is imperative, not only for aesthetic purposes but also, for health and environmental issues. The current SWM of Pakistan is ineffective, but by giving

Maxim

Day / Date

it attention and making some amendments, the system can be ameliorated

4a) 1) Introduction:

National Environmental Policy, designed in 2005, was a comprehensive framework that addresses the country's environmental challenges, fosters sustainable development and promotes the conservation of natural resources. In simpler words, the policy aimed at balancing economic growth with environmental preservation.

2) Guide line for various sectors:

2.1) Water supply and Management:

Pursuant to the guidelines laid down by the Environmental Policy the supply of water was to expand and cover more areas particularly arable lands. Moreower, the water resources were to be conserved and there should be a sustainable supply and access to safe water supply. The Guidelines also ~~extede~~ encompassed the ~~at~~ use of modern

Maxim

Day / Date

technologies that could assist in reaching the targets.

2.2) Air Quality and Noise:

The guidelines setforth also addressed Air Quality and Noise Pollution. According to these guidlines pollution reducing policies were to be implemented such as standardised vehicles, clean and pollution free technologies.

2.3) Waste Management:

Pollution and dirt caused by solid and liquid waste was to be prevented or reduced. In order to fulfill this, National Environmental Quality standards were to be introduced. Moreover a licensed discharge system was to be introduced and waste water treatment plants were to be proliferated.

2.4) Forestry:

It encouraged sustainable management of natural forests of Pakistan

Maxim

Day / Date

and increased forest cover for safeguarding economic growth and food security. It also promotes conservation and restoration of critically threatened eco systems.

2.5) Biodiversity:

It aimed to promote conservation & sustainable use of Pakistan's biodiversity and effective management of protected areas. It established a biodiversity action plan with the resolve to accomplish the aims mentioned above. there were to be new national parks and protected areas established.

2.6) Climate Change & Ozone Depletion:

It aimed to successfully and effectively address challenges posed by climate change and to address and protect ozone layer by implementing National Climate change policy & Action plan and by focusing on curbing the use of ozone depleting substances.

Maxim

Day / Date

2.7) Energy Efficiency & Renewables:

In the domain of energy, the objective of the policy was promote efficiency and renewable sources of energy to achieve self reliance in energy supplies. It concated a National Energy conservation policy and enact energy conservation legislation to foster renewable forms of energy.

3) Policy Instruments:

In order to successfull meet the set objectives, the policy also set fort key policy instruments. According to this, the integration of envivonment into development planning, Legislation and regulatory frame work, it fostered capacity development and also aimed to educate people by promulgating awareness.

4) Implementation:

Ministry of Environment was to develop "Action Plan" for the implementation and all relevant ministries would also devise plans to implement the policy provisions to their respective sectors.

Maxim.....

1) Introduction:

Eutrophication is a type of water pollution which, if left un monitored, can cause severe issues and lead to serious loss of biodiversity.

2) What is Eutrophication:

Eutrophication is defined as a natural or artificial addition of nutrients to water bodies that can, with the passage of time, can pollute the water and cause massive bio-diversity loss.

In simple words, it is denoted by the excessive plant and algae growth in the water bodies due to increased levels of nutrients it recieves in the form of nitrates and phosphates.

3) Process of Eutrophication:

Fertilizers flow into water bodies and

Date:

cause excessive growth in plant and algae. ~~in the water body~~. As the algae dies and decomposes, the high levels of organic matter and the decomposing depletes the water body of its oxygen content. Furthermore the algae covers the surface of the water-body, preventing the sunlight to penetrate. As the oxygen content decreases, the ~~living organisms~~ aquatic life does not receive adequate oxygen to sustain and therefore eventually die.

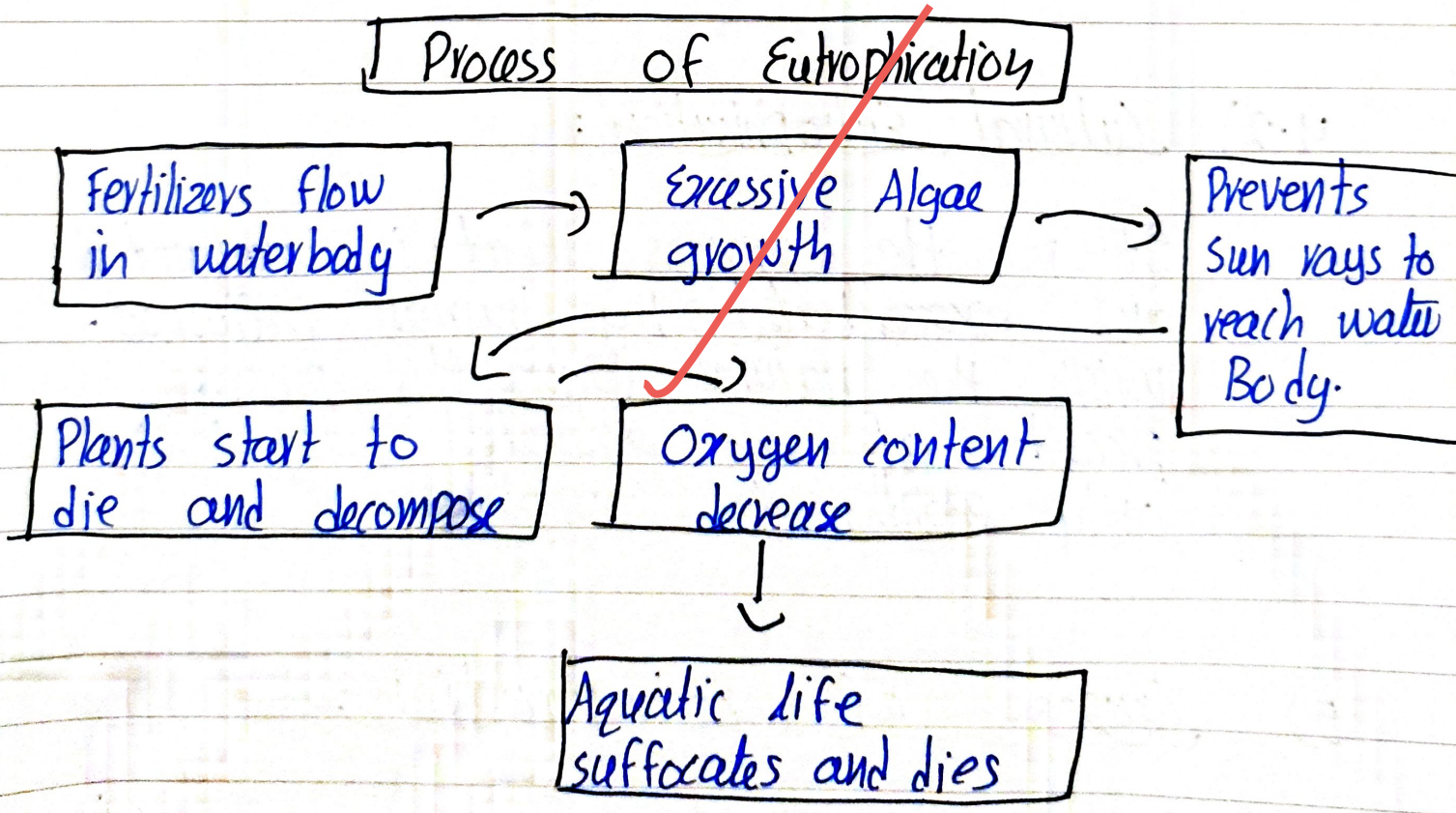

Fig 1: Process of Eutrophication

Date:

4) Types of Eutrophication:

Eutrophication is divided into two categories as follows:

4.1) Natural Eutrophication:

It is the natural eutrophication ~~of~~ takes takes place without any human influence. The Eutriphication proces begins and gradual proceeds slowly during decades.

4.2) Cultural Eutrophication:

It is the process that is accelerated and exacerbated by human influences. Unlike the natural form, this process proceeds at an accelerated pace, taking only months to complete.

5) Causes of Eutrophication:

There and sundry causes of eutrophication and some of them include.

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sewage effluents, Organic wastes, Agricultural run off ets

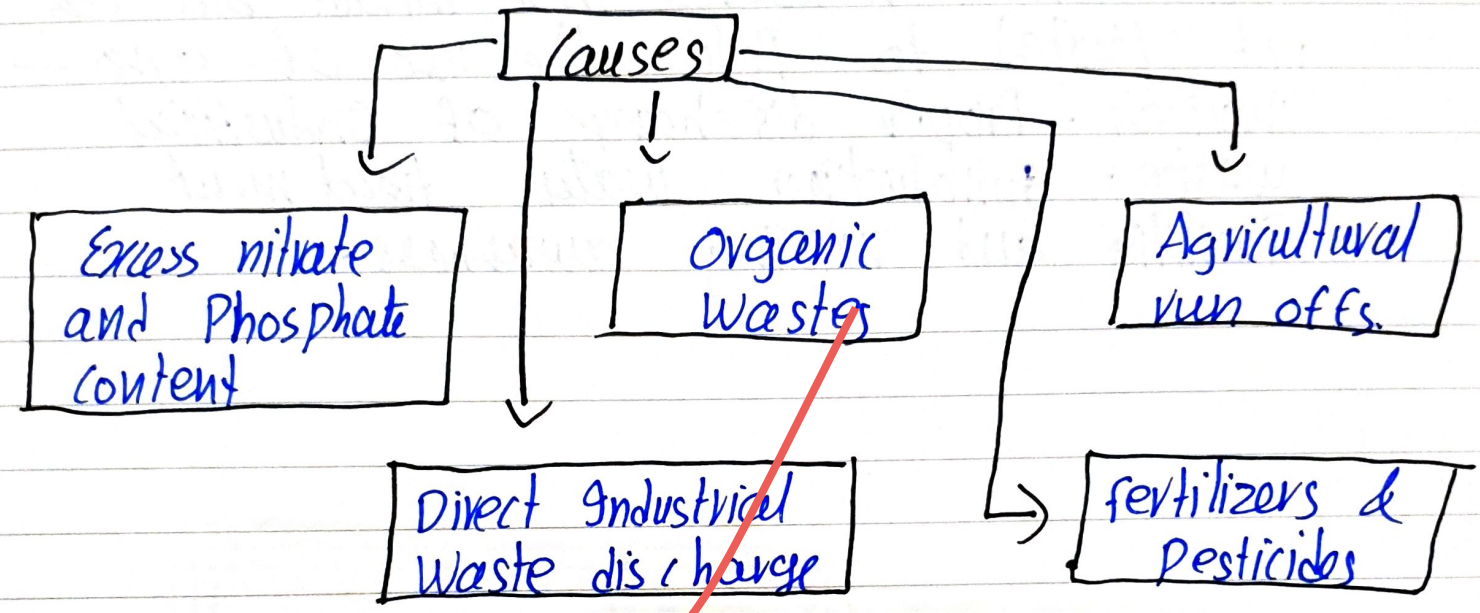

fig 2 : Overview of causes.

6) Effects:

The effects include water clarity. It also affects the colour and taste of the water. As aforementioned it leads to a massive loss in Biodiversity

Day / Date

7) Preventive Measures:

7.1) Proper Disposal of Industrial waste:

As aforementioned Industrial waste is one of the major contributers that ~~that~~ expedites eutrophication. Hence Industrial waste should be properly disposed in designated disposal areas to ensure none of the waste enters any near-by water body.

7.2) Reduce the use of Agro-Chemicals:

Agricultural runoffs is an major cause of eutrophication. Since its very likely that the runoffs can reach water bodies, and extremely hard to prevent them from reaching water bodies, a possible solution is to curb the usage of chemicals in agriculture.

7.3) Awareness:

Government should launch awareness campaigns to disseminate how eutrophication occurs and how individuals can perform their part in preventing it. Such campaigns can be very fruitful

Maxim

Day / Date

Q7) A)

1) Introduction:

EIA, which stands for Environmental Impact Assessment, is a systematic process used to evaluate the potential environmental impacts and consequences of proposed projects, policies or activities. It ensures that development projects and activities are conducted in an environmentally responsible manner, minimising negative impacts and promoting sustainable development.

2) Projects EIA is employed:

-> Motorways
-> Fly overs
-> Housing
-> Urban centers

3) Objectives of EIA:

3.1) Sustainable Development:

One of the primary aims of EIA

Maxim.....

Day / Date

is to foster and promote sustainable Development. In recent times, the requirement for sustainable development is exhorted and its benefits remain unknown to none. In such an era, the role of EIA in promoting sustainable development cannot be overlooked.

3.2) Integrating environment into planning process:

The most important objective of EIA is to integrate environmental concerns into the planning phase of any large-scale projects. By using different means to ascertain the potential damages caused to the environment, the EIA suggests amendments to the project that can mitigate the negatives.

3.3) Environmental Education / Awareness:

EIA also contributes in promulgating environmental education and disseminating awareness amongst the populace. There are many phases during the process of EIA where locals are consulted ensuing in Public awareness

Maxim

Day / Date

4) Process of Environmental Impact Assessment (EIA):

4.1) Project screening:

involves checking if the project is requires invoking of EIA. several factors are weighed in deciding this such as, project size, location, nature. etc.

4.2) Scoping:

In this step, the key issues and concerns related to the project's potential impacts are identified.

4.3) Baseline Data Collection:

This step encompasses collecting and understanding existing environmental conditions in the project area, such as forest cover, water bodies, population fisheries etc.

4.4) Impact Prediction:

In this step, the potential impacts of

Maxim

Day / Date

the project are ~~identified~~ predicted based on the collected base line data.

4.5) Mitigation and Alternatives:

measures are proposed to reduce and eliminate negative impacts of the projects. Considering the gravity of negatives, project design and alternative locations can also be propounded.

4.6) EIA Report:

EIA compiles all the garnered data and information into a report.

4.7) Review and Approval:

EIA Report submitted to relevant authorities for review and approval. The decision outcomes can come in approval, modification, rejection.

4.8) Public Participation:

This step includes consultation with the affected communities, stakeholders to weigh in their opinion

Maxim

Day / Date

4.9) Monitoring and Compliance:

If the project is approved, monitoring and compliance measure are installed in place to ensure the project adheres to mitigation measures

4b) 1) Introduction:

It is a science of recognition, anticipation, education, prediction, avoidance, or reduction of any damage caused by hazards arising in or from any workplace, which may damage the well being of workers & surrounding communities.

2) Hazards:

Hazards are anything that have the potential to damage. The most notable classifications of hazards are enumerated as follows:

2.1) Physical Hazard:

Includes heavy machineries and equipment

Maxim

Day / Date

2.2) Chemical Hazards:

includes gases, fumes and Acids etc.

2.3) Biological Hazards:

are bacterias, viruses etc.

3) Occupational Health and Safety Management Model:

3.1) Policy and commitment:

Organisations are required to develop an OHS policy that outlines the commitment to providing a safe & healthy work environment.

3.2) Planning:

Involves identifying hazards, assessing their risks, and establishing controls to mitigate the potential dangers. It includes setting objectives and targets for OHS performance improvement.

Maxim

Day / Date

3.3) Implementation & Operation:

Organizations need to implement the necessary processes, procedures, and resources to manage OHS risks effectively.

3.4) Performance Evaluation:

Regular monitoring and measurement of OHS performance to ensure goals are achieved.

3.5) Continual Improvement:

Organisations are expected to actively seek opportunities for improvement in OHS management systems.

4) Benefits of OHSAS:

Some key benefits of OHSAS are enumerated as follows:

- Improves reputation of organization
- Improves motivation among the workers
- Improves production / manufacturing
- Avoids violation of national & international standa
- Ensures safe and healthy environment

Maxim

a) 1) Introduction : What is Biodiversity :

Biodiversity refers to the variety of living organisms found in a particular ecosystem, region or entire planet. It encompasses the diversity of species, genetic variation within species, and the variety of ecosystems and ecological processes that support life. The Convention of Biodiversity, defines biodiversity in the following words:

" The variability among living organisms, from all sources including inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.... "

2) Classification of Biodiversity :

Biodiversity is classified in three categories which are as follows:

Maxim.....

Day / Date

2.1) Species Biodiversity:

This refers to the variety of living species or organisms existing in marine, terrestrial and aquatic sources. It includes a full range of species from microorganisms to giants and variety of plants.

Example:

It includes viruses, bacterias, multicellular plants and even fungi.

2.2) Genetic Biodiversity:

It refers to variability of genes available in single species. It includes the genetic variations within species, both among geographically seperated population and among individuals within a single population.

2.3) Ecological Biodiversity:

It encompasses variety of

Day / Date

ecosystems on earth. It studies variation in the biological communities in which species exist.

Example:

deserts, lakes, ponds, forests, etc.

3) Loss of Biodiversity and its causes:

3.1) Loss of Biodiversity:

Biodiversity is diminished by a number of factors, including both natural changes and human disruptions. The loss of even a single species is considered a tragedy as it is a irreplaceable substance of genetic material. This ultimately can alter the food chains which can disrupt the ecosystem and ~~unbed~~ upset the balance of nature.

3.2) Major Threats to Biodiversity:

Following are the major threats to

Maxim

Day / Date

biodiversity:

3.2.1) Habitat loss:

Human encroachments can have a dive impact on biodiversity. When humans' involvement in wild areas increase, it can result is destruction of natural habitat for wild animals.

3.2.2) Over hunting:

Over hunting is another major threat to biodiversity. When humans inautiously hunt animals, without giving heed to the possible reperussions, it can bring many species on the verge of extinction.

3.2.3) Invasive species:

Invasion of non-indegenous species could upset the balance of an ecosystem. When non-native species migrate to another ecosystem, they can bring the native species on the verge of being extinct.

Maxim

Day / Date

3.2.4) Pollution:

Pollution can pose a major threat to Biodiversity. It can affect an ecosystem in sundry ~~mmm~~ ways. Contamination of water can kill marine life. On the other hand, contamination of soil can also impact plants and, mostly, herbivores.

3.3) Causes of loss of Biodiversity:

3.3.1) Deforestation:

extensive and reckless cutting of trees can plague the biodiversity of an area. The indiscriminate cutting of trees can erase may ecosystems, leaving ~~inhabited~~ massive loss of live amogst the inhabitants.

3.3.2) Careless use of Pesticides:

Pesticides might provide the crops with some protections, but in a broader spectrum, it has a detrimental role

Maxim.....

Day / Date

The pesticides can also, along with the insects that harm crops, kill many ~~be~~ insects that have a beneficial impact such as bees, butterflies.

3.3.3) Poor Disposal of Sewage:

Sewage contains high level of nutrients such as nitrogen etc. when this enters water bodies, it can lead to excessive enrichment of nutrients, which ultimately leads to eutrophications, resulting is massive loss of life.

3.3.4) Heavy Machinery:

Machinery, particularly heavy equipment, can inadvertently harm wildlife through collisions, entanglements during operations. This, as a corollary, can impact the biodiversity.

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8 b) 1) What is Remote Sensing:

Remote Sensing is a process of gathering information about Earth's surface using various type of sensors equipped on aircrafts and satelites.

2) How does remote sensing work:

The process of remote sensing begins with the energy source [ie Sun] illuminating the targetted area. The radiations emitted from the energy source reach the target areas. Some of this light is absorbed by the target and the remaining is reflected off. The reflected light is intercepted by the sensors, which measure its intensity and convert this information into digital form. The data collected from the sensors is sent

Date ____ 20 ____

to processing station, where the data is processed and useful information is extracted. This information is then analysed and interpreted

3) Important Implications :

The data gathered and interpreted is then used in many sectors. It helps in recognizing macro-patterns. The data can be used closely monitor environmental resources e.g forest cover. Other envivomental changes such as glaciers melting, can also be monitored. This sort of information is essential for conceiving effective envivonmenal policies and for anticipating any envivonmental hazards such as floods. It also assists in disaster management and urban planning.

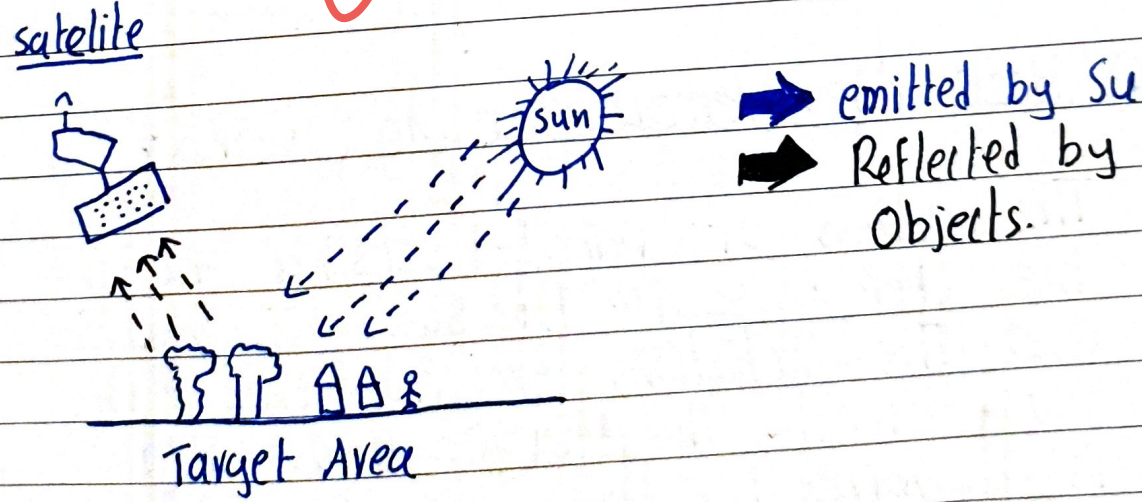

Figure : Brief overview of Remote sensing

Day / Date

Q8c) **REDD+**

→ REDD+ ; stands for Reducing Emmisions from Deforestation '+' indicates inclusion of activities beyond deforestation.

→ REDD+ is an international mechanism under negotiation within the UN climate talks.

→ will provide compensation to government, communities, companies or individuals in developing countries for actions taken to Reduce Emmissions from Deforestation and forest Degradation.

→ FCFP: Forest carbon Partnership Facility (FCPF)

→ support countries in their efforts to reduce emissions from deforestation & degradation (REDD+)

⇒ objectives

1) Capacity Building: financial & technical assistance to help build capacity for implementing REDD+

2) Financial Incentives: Financial incentives for countries that demonstrate significant reductions in GHGs & REDD.

3) Safeguards: Incorporates safeguards to ensure REDD activities respect rights of natives, local communities.

4) Transparency: promotes transparency and accountability in the management of funds & implementation of REDD

Maxim

Day / Date

=) REDD in Pakistan:

-> Pakistan forest 5% of total area
-> Deforestation in Pakistan at a rate of 0.75% per year. [FAO, 2007]

=> Objectives

-> capacity development of prime stake holders in REDD+ concepts
-> Developing a national policy & implementing REDD+
-> national REDD+ programme.

10

4th part missing.