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Q. What are the suitable technological approaches to counter environmental pollution. Explain.

1. Introduction:

Environmental pollution is a global concern which is hovering like a monster all around the globe. Different kinds of pollution needs different technological approaches. For instance, air pollution can be reduced by using dust control systems and scrubbers. Water pollution can be controlled by using techniques like sedimentation, coagulation, filtration. Similarly, land pollution requires proper disposal of waste by using incineration, landfills etc. Each approach has its significance and drawbacks.

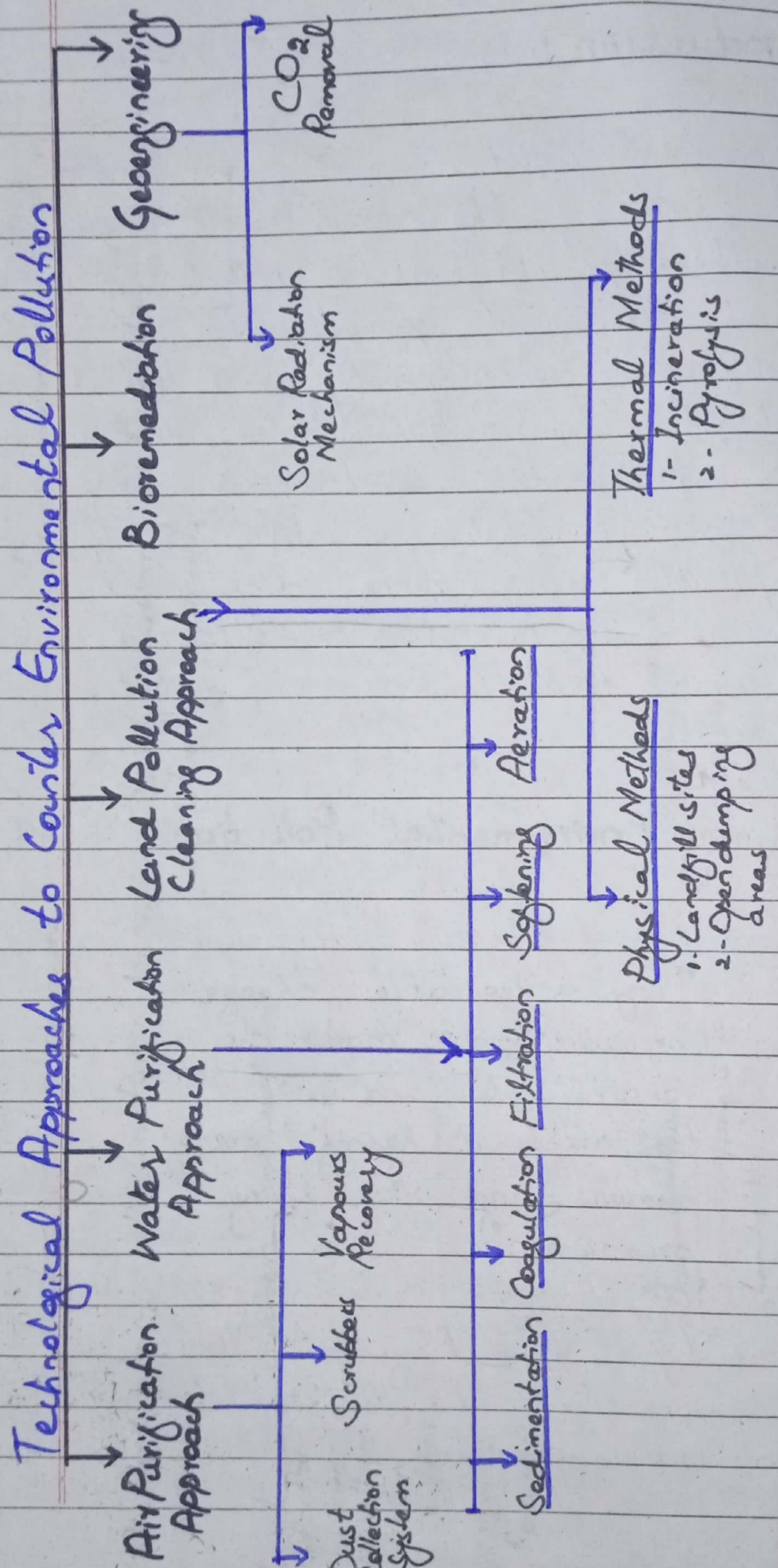
2- Defining Environmental Pollution:

Environmental Pollution is defined as:

“any undesirable change or addition of materials in air, water and soil that makes it harmful for humans and other living organisms.”

Environmental pollution contaminates the natural environment of living organisms therefore, it is crucial to treat them by using technological approaches.

3- Technological Approaches to Counter Environmental Pollution:

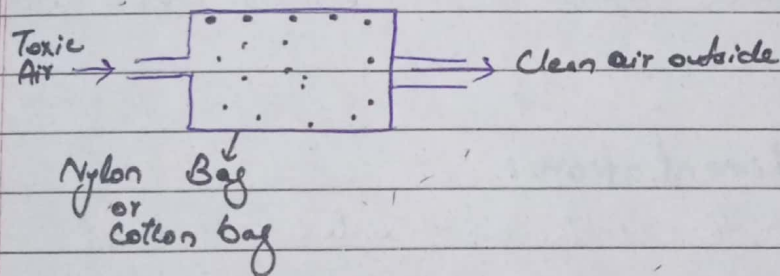


i- Air Purification Approach:

Air pollution is leading cause which contributes to global warming among other types of pollution. It is estimated to cause about 3.7 million premature deaths and destroys enough crops to feed millions of people every year. In Pakistan, Lahore is the most polluted city with Air Quality Index of 301 which is hazardous. Air purification is done through following ways:

a- Dust Collection System:

This method is used in cement industries, food industries, paint industries for collection of dust. In this method, a fabric is used to capture dust when gas passes through it.



b. Scrubbers:

Scrubbers are used to capture Particulate Matter (PM) and gases from industrial exhaust gases. Scrubbers may be wet or dry depending on type of material used.

c- Vapours Recovery System:

Vapour recovery system is used at fuel stations to reduce the emissions of gasoline in the atmosphere. It is done at

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two stages: first when gasoline is transferred from trucks to storage tanks and second from transferring fuels to cars. It uses nozzels, vacuum pumps etc, to reduce the emissions.

ii. Water Purification Approach:

Water is essential for life however, the recent pollution trends have made it a threat to human life. According to WHO report 2022, around 1.2 bn people around the globe are drinking water contaminated with faeces. Similarly, according to UN estimate, after floods of 2022 in Pakistan, around 10 million people do not have access to safe drinking water. Different water purification approaches used to treat water pollution are as follows:

a. Sedimentation:

In this method, water is kept stationary so that all the heavy particles start settling at the bottom. This is an effective approach to treat pollution.

b. Coagulation:

Coagulation is a technique which is used to remove chemicals from water bodies. A coagulant like Alum is used which solidifies the impurities present in water.

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c. Filtration:

Filtration is a method which is commonly used in cities to ensure the safe access to drinking water. For instance, within Islamabad city, different filter plants have been installed for public. During filtration, water is passed through filter paper which removes filterable impurities from water.

d. Softening:

Heavy metals like Lead, Arsenic, Cadmium etc which are hazardous for health as well as make the water hard. In that case, softening agents are used through different process like reverse osmosis etc.

e. Disinfection:

Disinfection is necessary for removal of bacteria from water. For example, presence of *Salmonella Typhi* in water causes typhoid in humans. Most common disinfectant used to treat water is Chlorine (Cl).

iii. Land Pollution Cleaning Approach:

Solid Waste Generation is the leading cause which leads to land pollution. As per figures of statistics, approximately 2 billion metric tons of solid waste is generated every year, which is expected to rise by 70% by 2050. According to an estimate, Pakistan generates 49 million tons of solid waste every year.

Therefore, it is pertinent to manage solid waste from transferring till its disposal. Different techniques to reduce solid waste are as follows:

a. Physical Methods :

Physical methods involves different techniques to reduce land pollution, for instance Open Dumping and Landfill sites. In Islamabad, CDA has used landfill sites of I-12, H-16 and at Chak Beli Khan Rawalpindi. There is a limiting capacity of every landfill site and after reaching certain limit, it needs to be closed. During planning of a landfill site, a material is used at the base of site to avoid the leachate to enter soil or ground water. In rural areas, solid waste is dumped at open areas which are collected by municipal authorities.

b. Thermal Methods :

Thermal methods are those which required very high temperature to burn solid waste and to reduce its volume. Large scale incinerators with temperature of around $300 - 400^{\circ}\text{C}$ are used to burn a large chunk of solid waste. During the process, heat is generated which can be useful for different purposes. Other thermal methods include pyrolysis and gasification, which are

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useful in reducing environmental pollution.

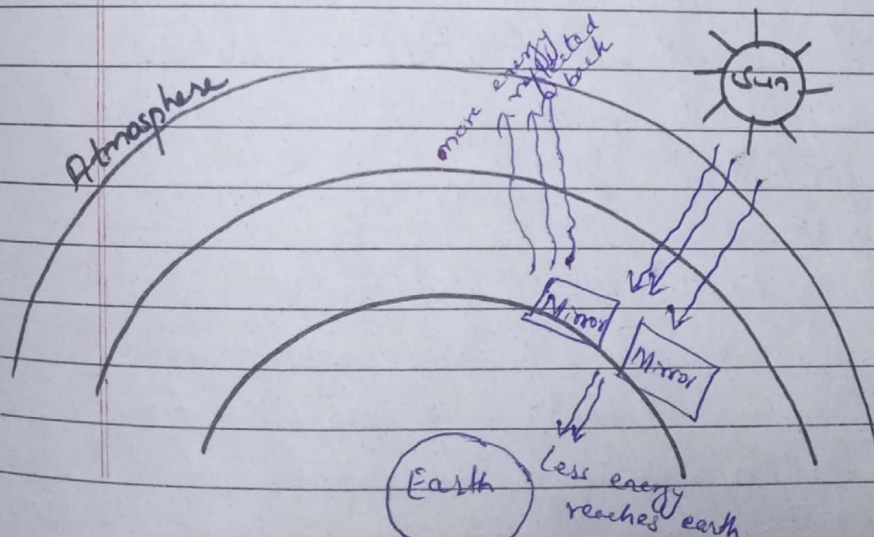
iv. Bioremediation :

Bioremediation is a process used to reduce environmental pollution through living organisms. For example, through phytoremediation, a hazardous site can be transformed into a safe site. Similarly, use of microorganisms for converting organic waste into useful products is also form of bioremediation. An underdeveloped village in Bangladesh called Barishal Village has unlimited supply of biogas for cooking purposes.

v. Geo-engineering :

Geo-engineering is an approach to treat environmental pollution in two different ways :

a. Solar Radiation Mechanism :



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Due to different anthropogenic activities and high level of pollutants increase the CO_2 in the atmosphere which leads to global warming. CO_2 for environmental management, SRM is used.

6. CO_2 Removal:

To reduce the CO_2 gas in the atmosphere, Iron is added to the oceans to enhance the growth of phytoplanktons. These phytoplanktons consume the CO_2 present in the atmosphere for the process of photosynthesis. In this way, CO_2 removal process act as another technological approach to reduce pollution.

4. Efforts of Pakistan in Combating Environmental Pollution:

Pakistan has taken different measures to combat environmental pollution, for instance, National ^{Water} Sanitation Policy. Pakistan also ratified Kyoto Protocol and REDD+ to reduce emissions in the atmosphere.

Similarly, recently Toyota has invested 100 million to introduce electric cars in Pakistan.

In 2023, Ministry of Climate Change also introduced Clean Air Policy.

5. Conclusion:

In a nutshell, environmental pollution is a significant concern which is threat to life on earth. Different technologies can be used to reduce its impact. Every approach has its pros and cons which should be kept in mind while treating.