

Environmental Science

Q.1 Explain the process of EIA and shed light on the importance of EIA. (10)

Outline

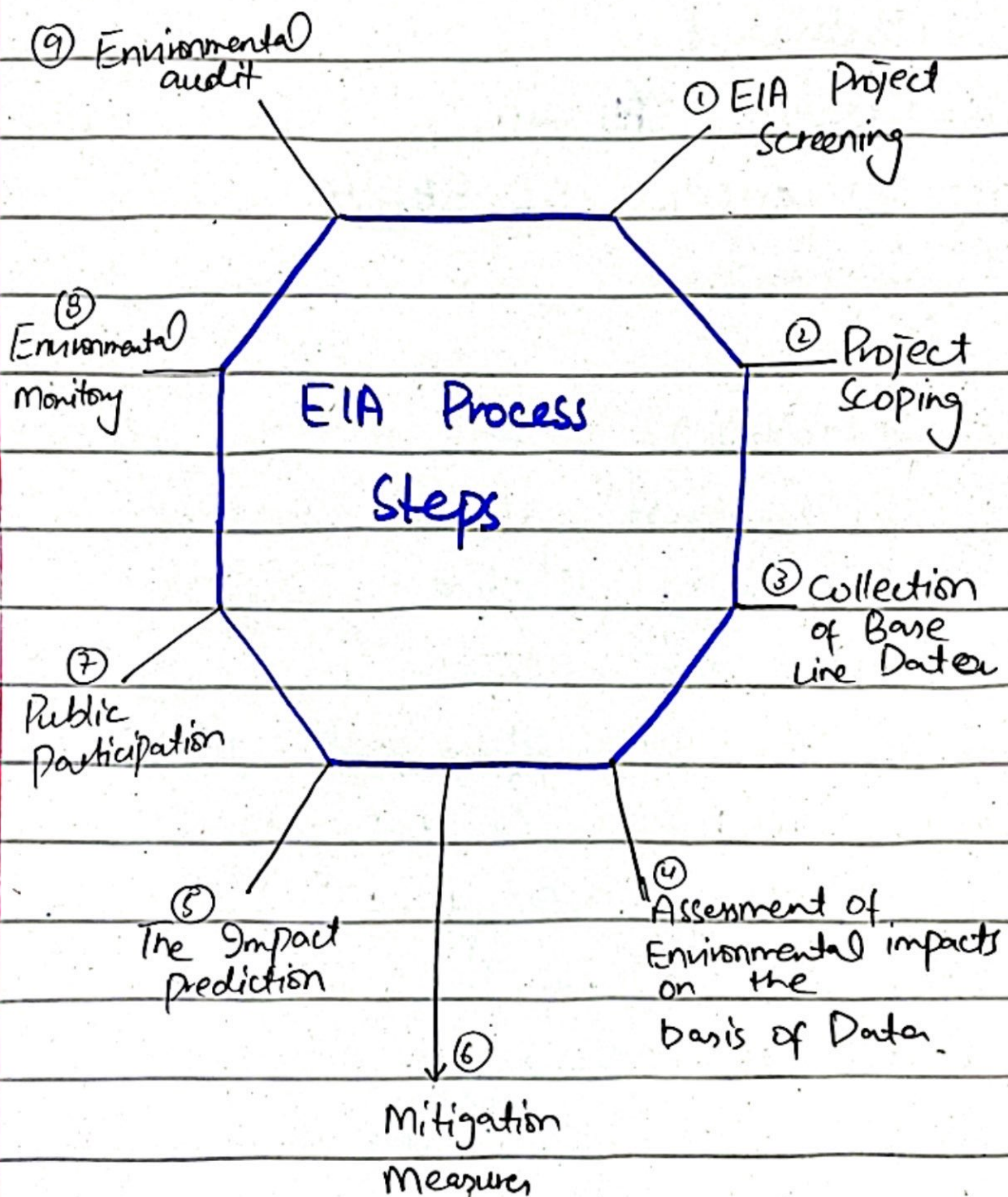
- 1- Introduction
2. Process of ~~EIA~~ EIA
- 3- Importance of ~~EIA~~ EIA
- 4- Conclusion.

1- Introduction :-

EIA (Environmental Impact Assessment) is a mechanism adopted by investors to initiate any project. EIA was firstly adopted in USA and after Earth Summit, it became part of the world. In Pakistan, PEPA Act 1997, Article - 12 - ensures the compliance of EIA. Its process consists of two steps; EIA conduction and EIA approval. The process is much beneficial to give general awareness to community and its adoption of certain mitigation measures to lessen environmental impacts.

2. Process of EIA :-

EIA is conducted by special team and it may be private or government. While its approval must be by governmental agency.



Now, let us explain these steps one by one;

1- EIA Project Screening

In this step the investor share file of project with team. The team evaluate:

- ① How much investment
- ② Cost of project
- ③ Location of project

Assessment :-

If the investment is less than Rs 10 million, then there is no need of EIA and if more than 10 million then move towards next step. This is criteria in Pakistan.

2- Project Scoping

The scope of project is checked:

- ① Either it is beneficial to society
- ② Also check its impact on human life.

3- Collection of Base Line Data

For it, the team must has a site visit. Check the location of project means if it is

road project. Note down following parameters:

- ① The road passes near population
- ② Number of displaced people
- ③ Lake or agricultural land is affected.

4. Assessment of Environmental impact On the basis of data

In step III, the data is collected now in step IV, evaluate the impact:

- ① If pollutants are present in air, how much air is affected?
- ② If pollutants are present in lakes, ^{how} much marine life is affected by it.

5. The Impact Prediction

In this step, the analysts, through scientific measures predict the future. The number of vehicles drive on the road and the emissions produce from them. After 5-years at what

entent, these pollutants would penetrate in the atmosphere.

6- Mitigation Measures

The mitigation measures are also adopted to counter the impacts of harmful emission in the atmosphere.

For example:-

If carbon emissions are added to atmosphere, plant more trees to eliminate it.

7- Public Participation

Public participation is also necessary and for that purpose, social media or questionnaire can be distributed to check public response on project.

8- Environmental Monitoring

When all these steps are completed the final report is send to EIA, EIA also has its own terms and

conditions. Furthermore, EIA team visit the project periodically to ensure that all conditions are followed or not.

9. Environmental audit

When the project is completed, the EIA team visit the project and compare the adaptation and mitigation measures at the project site with its own report. If all the conditions are followed then project will be opened Operational otherwise not.

3. Importance of EIA

EIA has special importance to ensure environmental protection and for sustainable development. Its importance is as follows:-

(a) Protection of violation of national and international laws:-

This audit will protect the new investor from violation of

national laws. As Article 9A of the Constitution of Pakistan says; clean environment is the right of every citizen.

(b) Mainstreaming of marginalized people:-

Through public participation, the grievances of marginalized people will be mainstreamed before the project continuation.

(c) Ensurance of Sustainable development:-

EIA ensures that there is sustainable development in society means all natural resources are preserved or not.

(d) Preservation of biodiversity:-

The biodiversity maintenance can be checked through EIA because EIA team firstly check the location of project and in this way forest areas remain intact.

(e) Adoption of Mitigation mechanism

This process has special importance in adoption of mitigation mechanism. As many industries have adopted ~~that~~ ^{many} techniques like Textile Industry has adopted bag houses technology.

Brick kilns are adopting zig-zag technology to reduce Carbon emission in atmosphere.

(b) Science can be instrumental in managing Pollution. Elaborate scientific measures/methods to control pollution (at-least 12).

Introduction :-

Technology is the cause of pollution ~~the~~ - fossil fuels burning at the start of industrial revolution - and now it can be utilized - catalytic converter, hydraulic pumps - to minimize pollution. Few decades ago, the world shifted from hydroelectricity to coal and oil based electricity generation. Now, the water is used as a

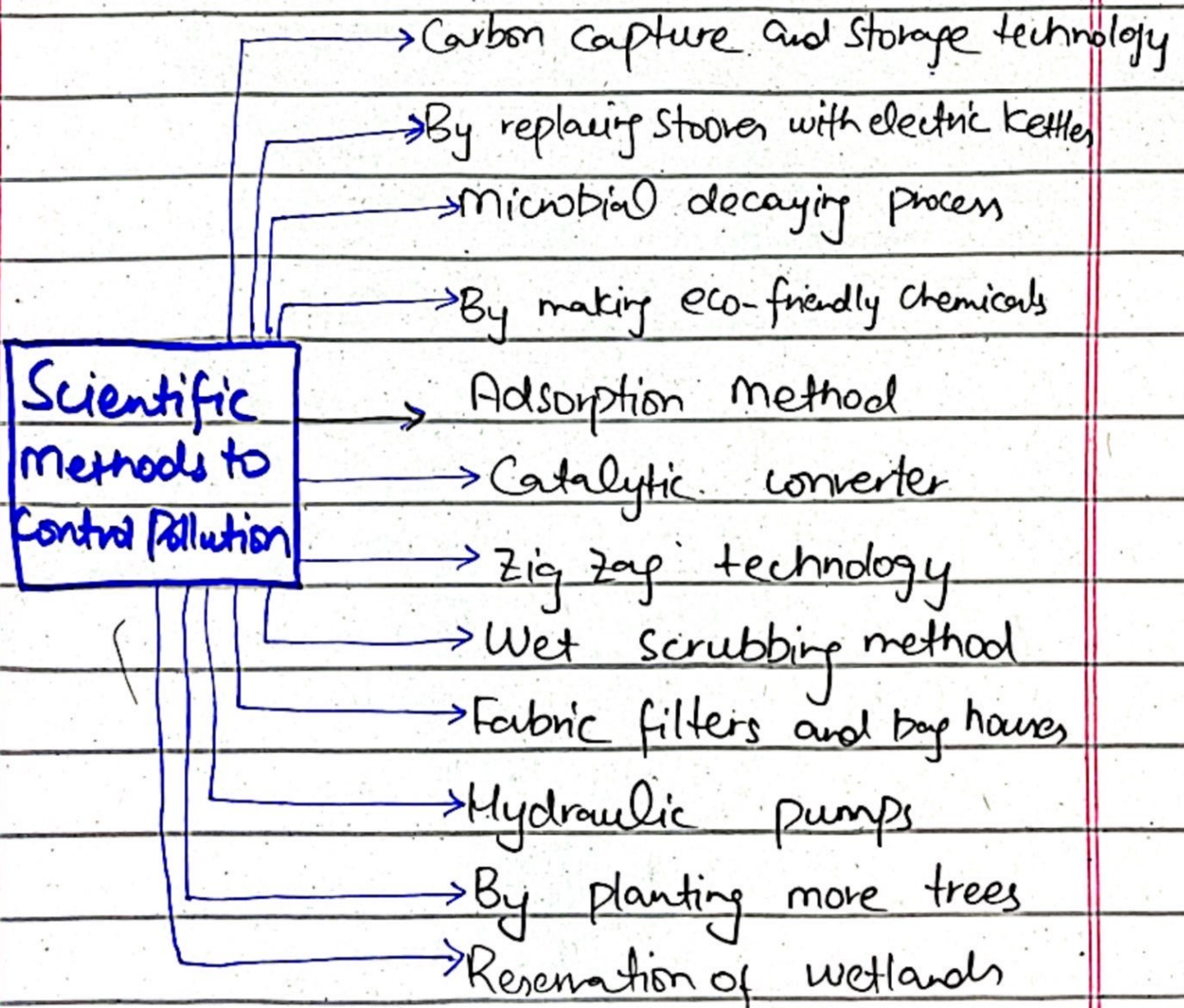
Wet Scrubber to minimize the smoke emission in atmosphere.

Scientific methods to control Pollution

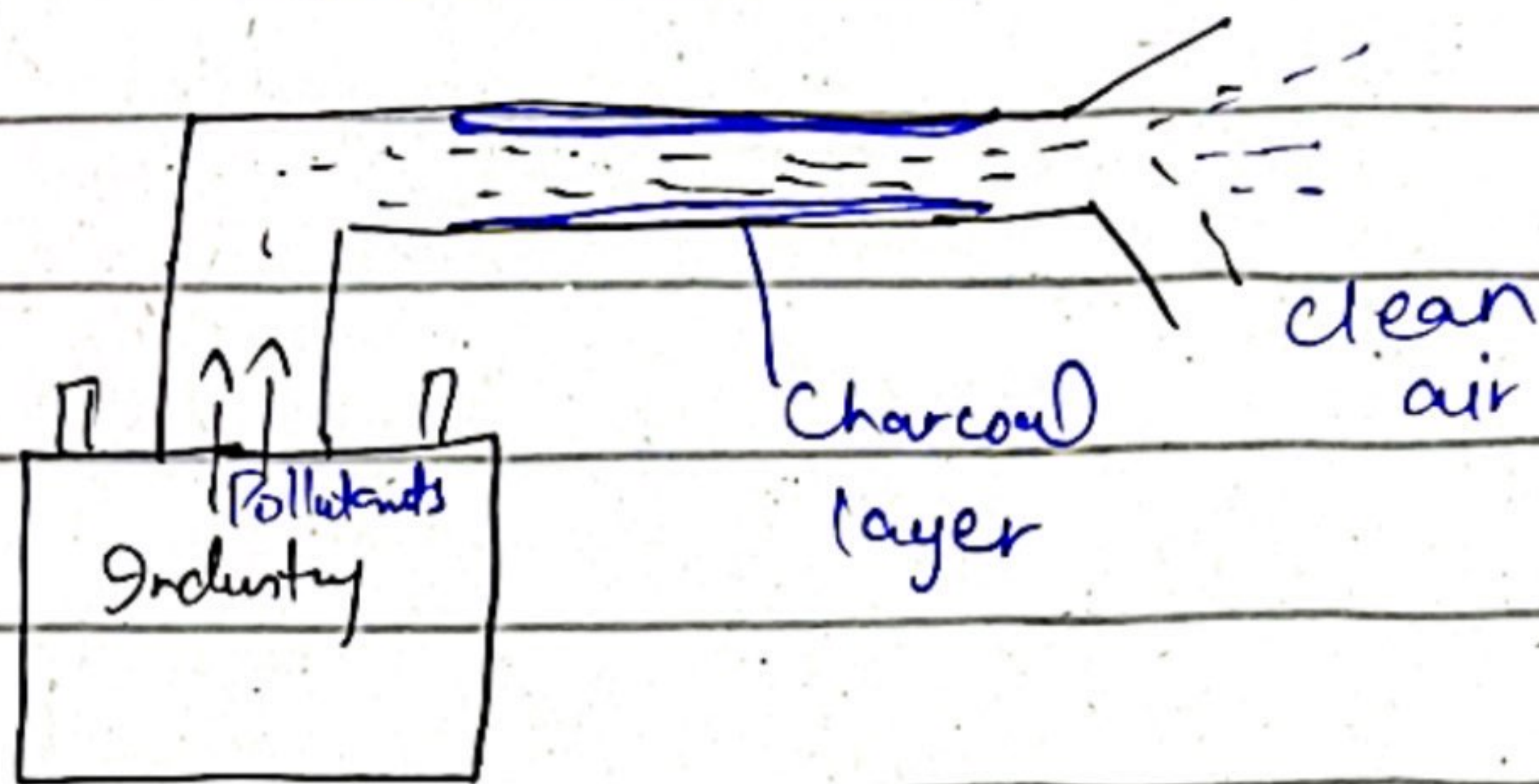
Pollution from atmospheric to marine to soil, all types of pollution can be minimized

through various scientific methods

There are as follows:-



1- Adsorption Method



In this method, internal surface of passage is coated with charcoal, it absorbs maximum pollutants.

Charcoal can be recycled and used again.

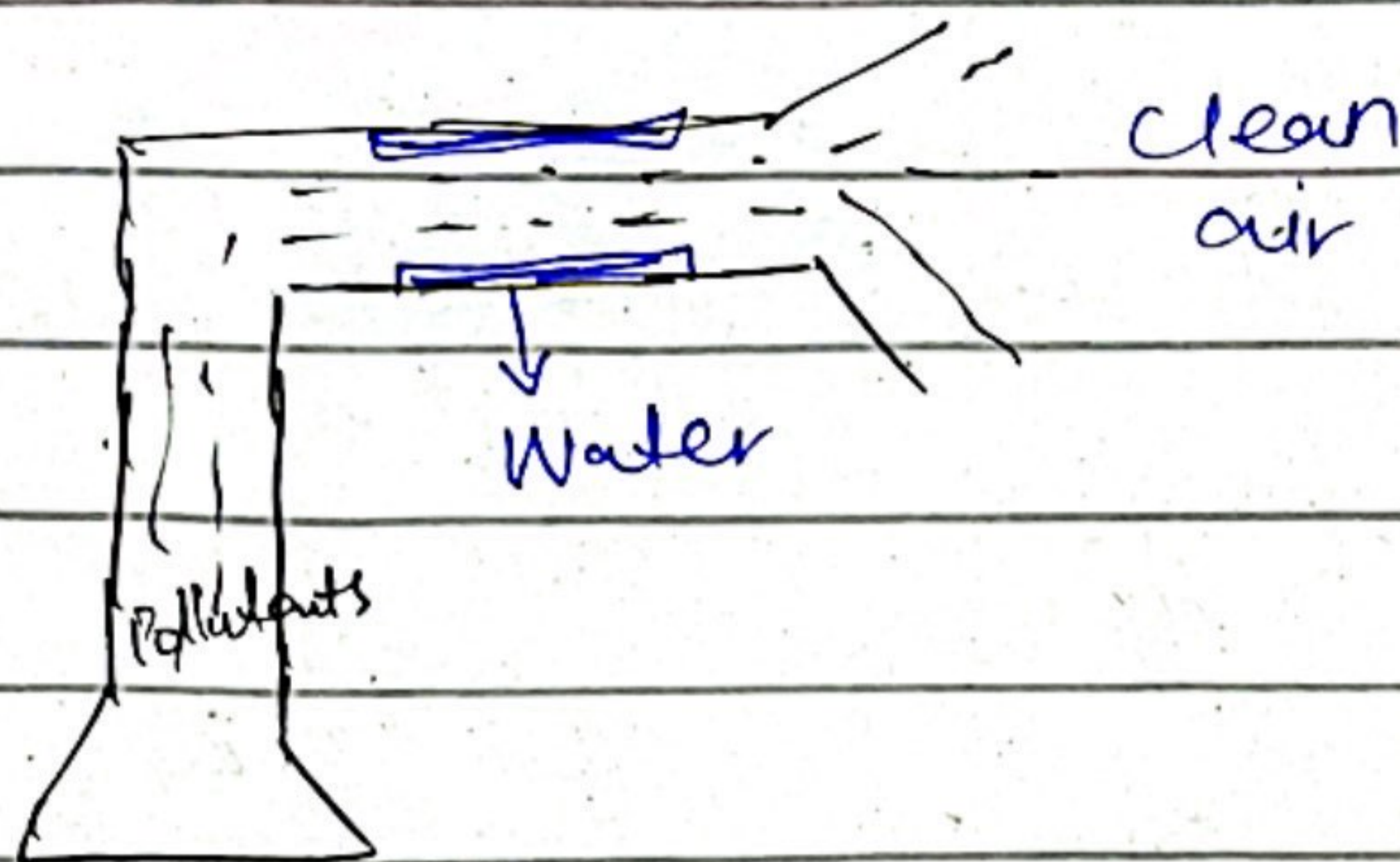
Importance :-

- This method is useful in treatment of Volatile Organic Compounds (VOC).
- Municipal waste
- Paint industry.

2- Wet Scrubbing Method

In this method water is added to the internal surface of passage. Most gases are soluble in water.

So, a less polluted air will be emitted.



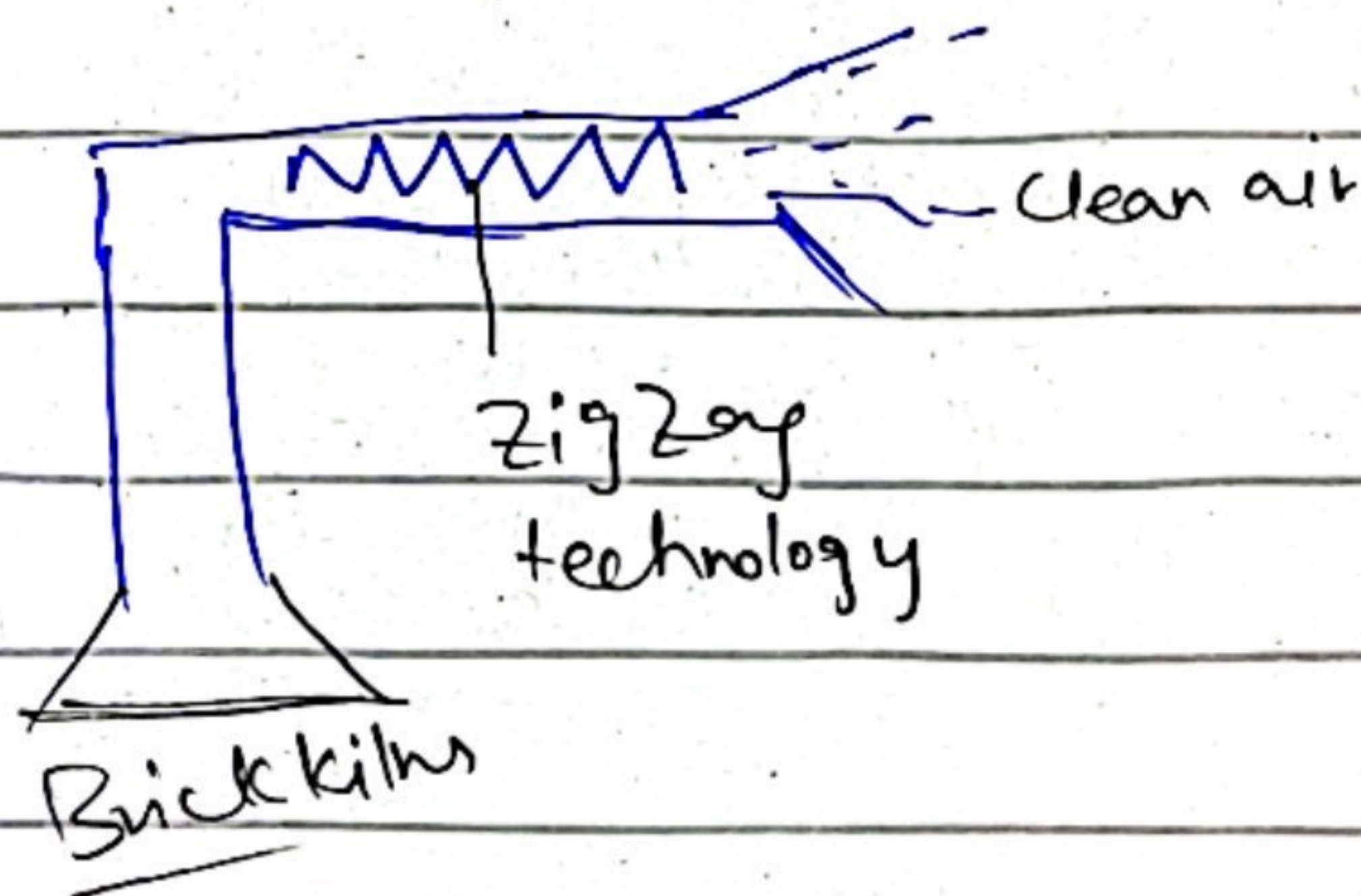
Brick kilns/Factory

In coal burning power plants it is useful.

This method is used to treat SO_2 and NO_x and other gases which are soluble in water.

Zig Zag technology

In brick kilns, this technology is used, to reduce the impacts of pollution in atmosphere.

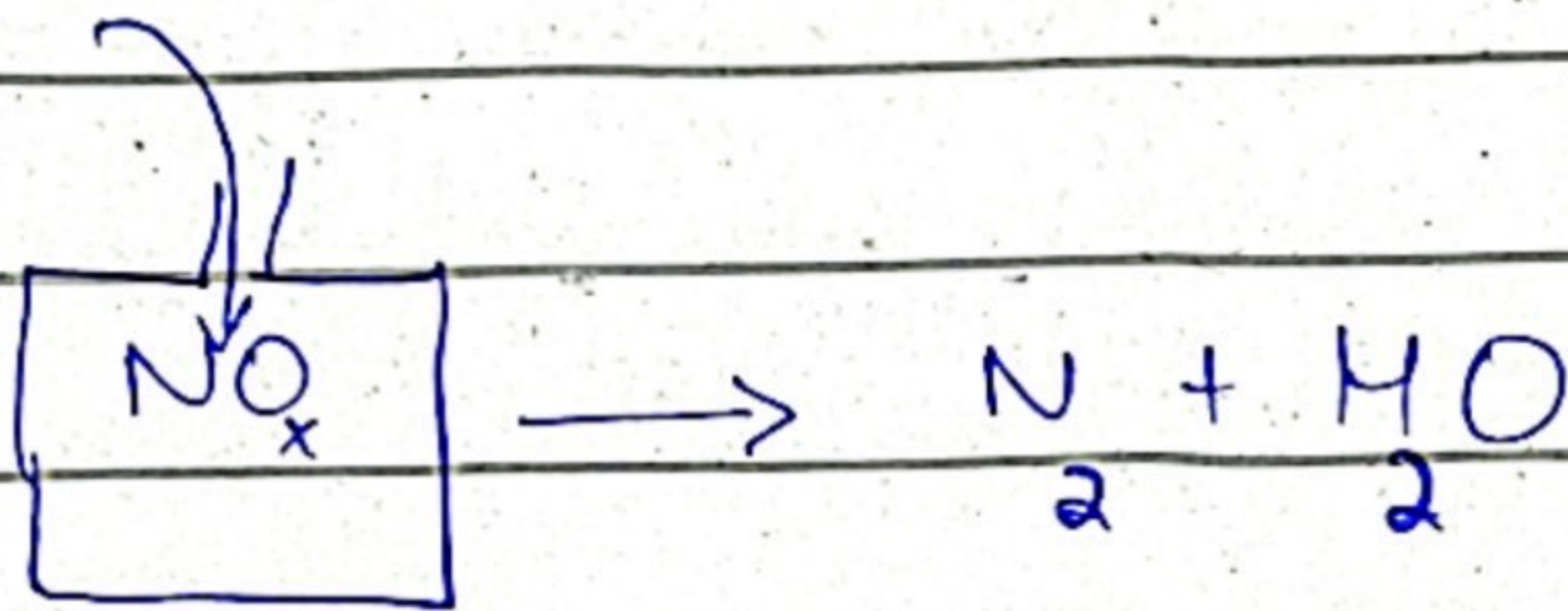


Catalytic Converter

Catalytic converters are used in automobiles which convert toxic gases into less toxic gases.

It is a chemical method and is applicable at nitrogen oxide product site. Ammonia inject in nitrogen oxides.

ammonia
 NH_3

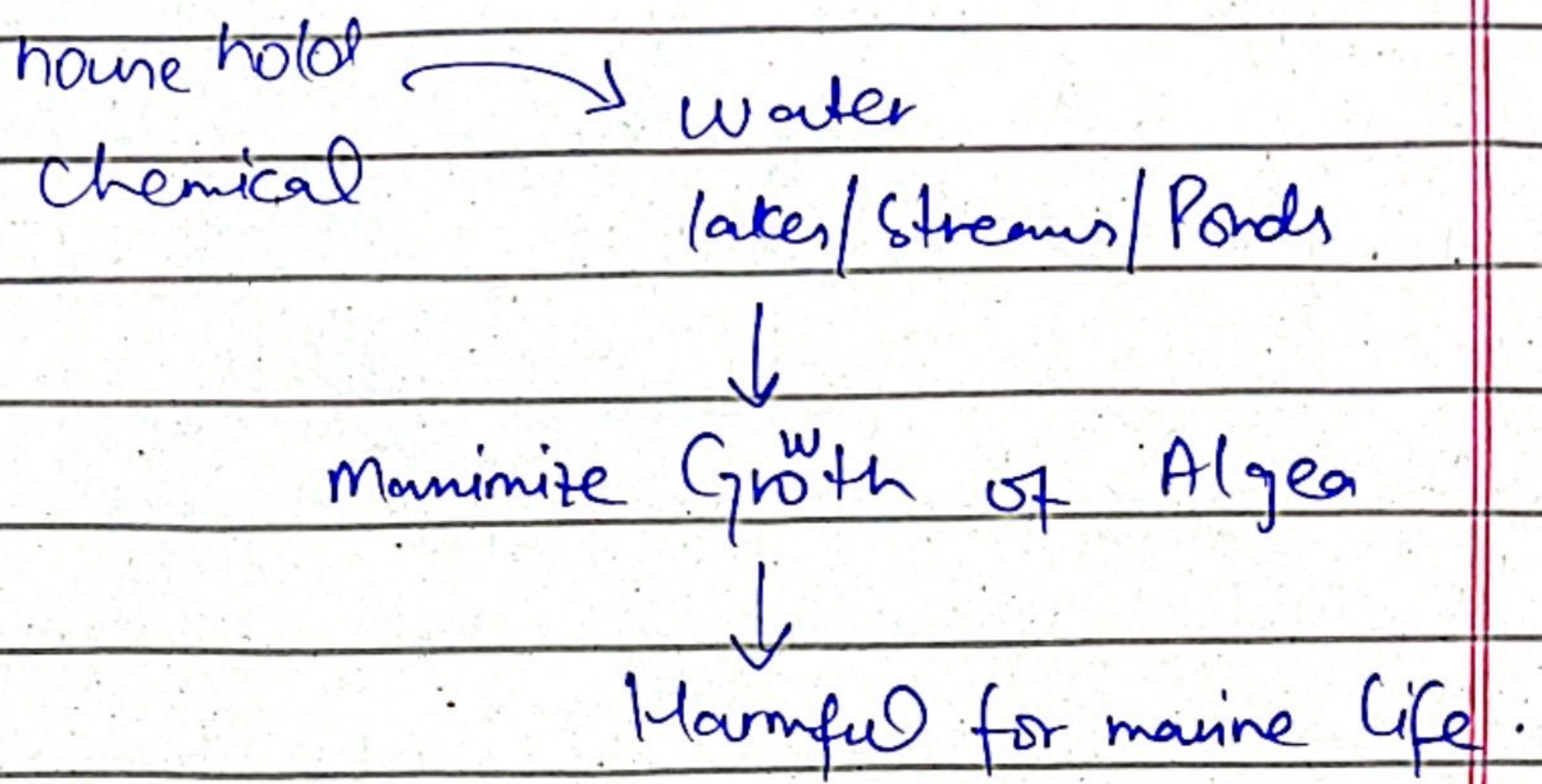


Application :-

Sugar Industry
Steel Industry

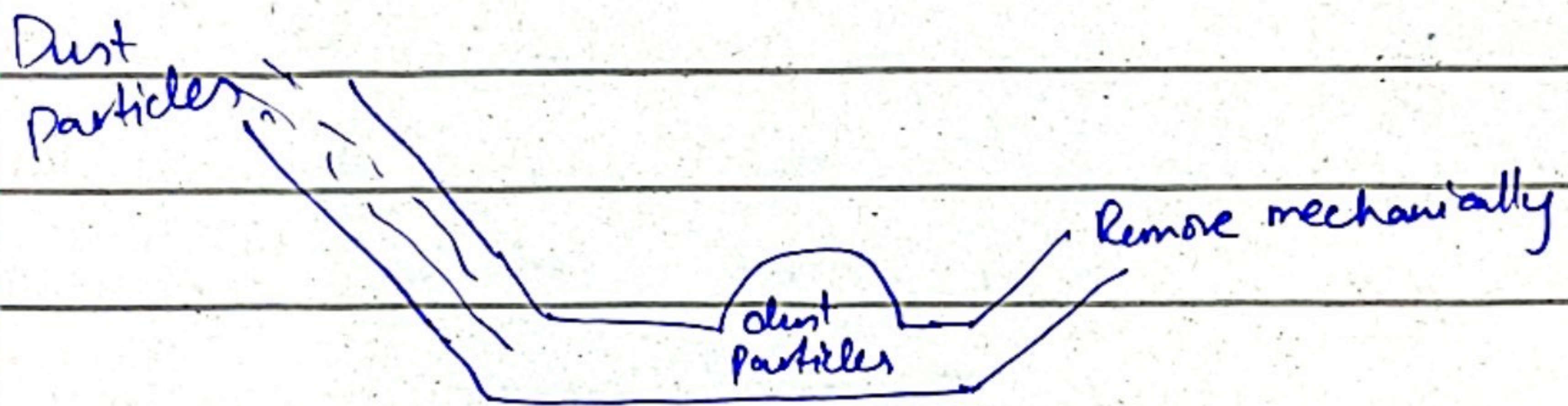
By making eco-Friendly chemicals :-

The chemicals which are used in households like Washing Soda, Harpic they kill micro-organisms which are useful in breakdown of complex compounds. Further they add in lakes water, where cause Eutrophication.



Fabric filters and bag houses

This mechanism works on the principle of vacuum cleaner.



Vacuum Cleaner

This technology is useful to capture solid particles of dust.

Application :

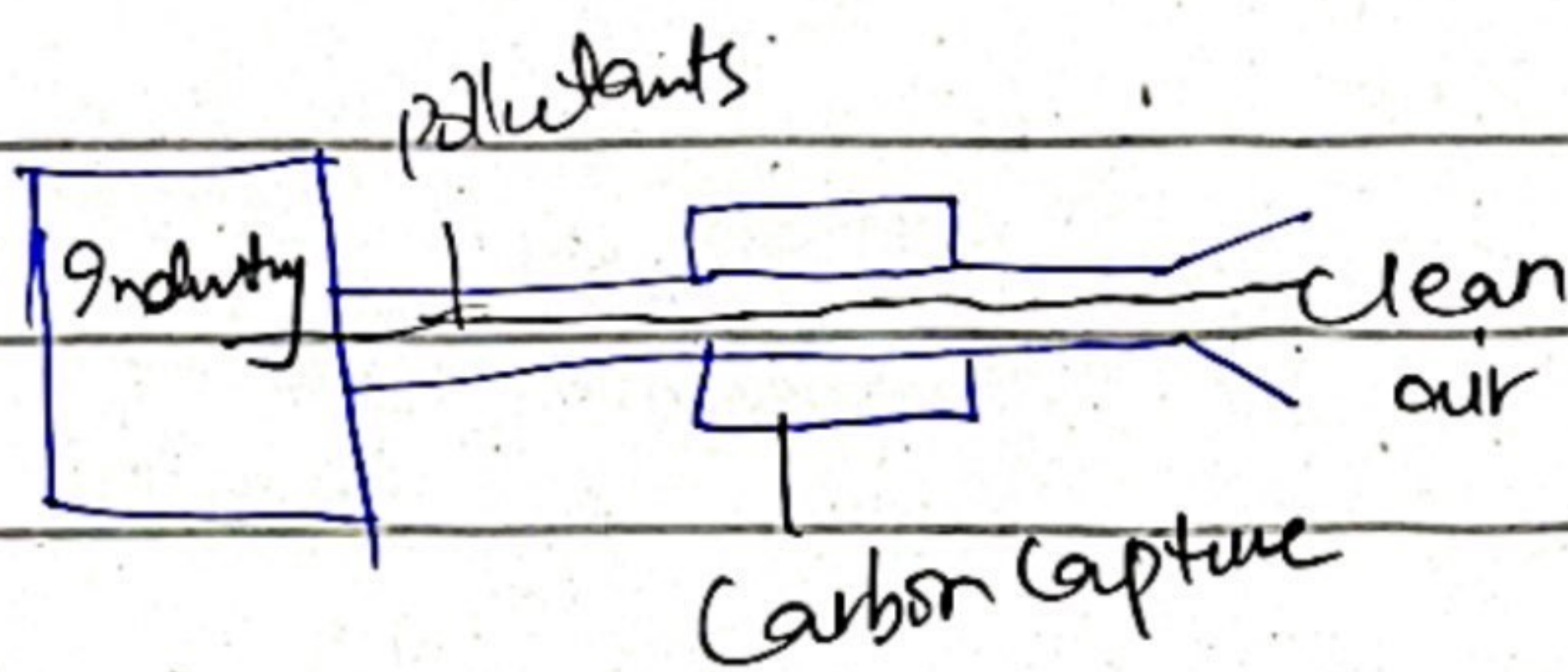
Textile Industries.

Carbon Capture and Storage technology

CCS technology is operational

Since 2000, this technology is

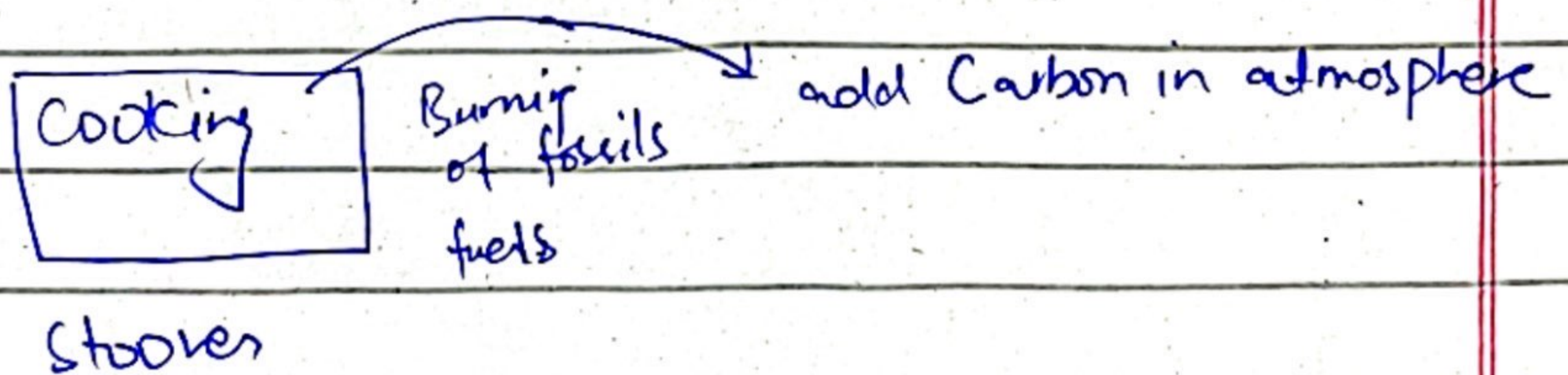
used to capture excess carbon.



But, this most is costly and it is not workable in Pakistan.

By replacing stoves with electric kettles

9n Pakistan's under-developed areas like Balochistan, still people use animal waste for cooking and there is no proper sanitation mechanism.



So replace them with electric cooking methods or natural gas. To avoid pollution in atmosphere. As Pakistan is Top included in Top-10 vulnerable countries of the world.

Microbial Decaying Process

Some micro-organisms are used to breakdown complex organic matter into simple one. For example,

Composting is a mechanism in which micro-organisms are used, these are;

Protozoans

Rotifers

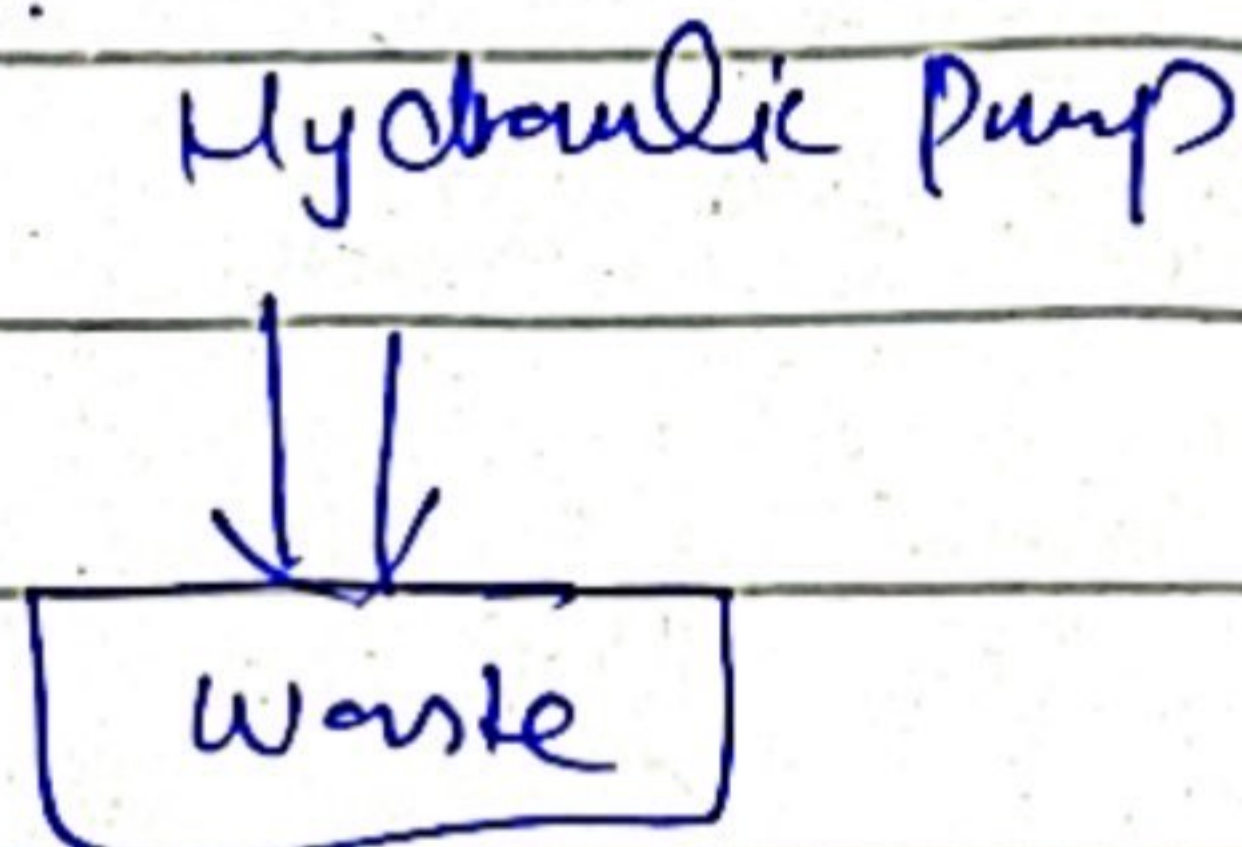
Beetles

Actinomyces

Staphylococcus bacteria etc.

Hydraulic Pumps

Hydraulic pumps are used at garbage collection sites. These pumps compress waste before incineration.



It reduces waste ~~size~~ volume

So it can be easily dumped.

In outskirts of Lahore, Gujranwala

these pumps should be implanted

to reduce waste.

By planting more trees

Trees are natural absorbers of Carbon, so by planting more trees the air pollution can be diminished.

Kikar plants have more ^{Carbon} absorption capacity.

By planting Mangrove Forests is another method to ^{Control} pollution.

Restoration of Wetland

By reserving wetlands, the ecology can be preserved. Benefits :-

- ① Aquatic life
- ② Atmosphere Cleansing
- ③ Tourist attraction.

The wetland in Lahore from Kamran Bera Dam to Shahdaman can be restored to minimize the effect of air pollution.

Because, Lahore is No. 1 city of the Asia which is vulnerable to climate change.

Q.2 Define Biodiversity loss give its causes and explain the Convention on Biodiversity (CBD).

Definition of Biodiversity :-

" Biodiversity is the variety of life forms which exist on planet Earth from all their sources of which they are part of including diversity within the species and among the species."

The term Biodiversity was firstly coined by " Thomas Lovejoy "

Biodiversity Loss

The disappearance of such a huge variety of organisms due to human activities and natural climatic changes is called biodiversity loss.

Causes of Biodiversity Loss :-

There are many reasons for such a huge loss, some are given below :-

① Population Explosion :-

With the rise of population, the needs of people also increase :-

- ① More houses
- ② More Jobs
- ③ More production.

So, there is cutting of more trees, natural discourse of water is also changed to fulfill human needs. This is reason of ~~populast~~ biodiversity loss.

According to Marine Policy Journal;

"About 1-3rd of Amphibians, Mammals and birds are at the threat of extinction due to biodiversity loss."

② Over-exploitation of Natural Resources :-

The natural resources are over-exploited to fulfill human needs, this is the reason that naturally occurring biodiversity is at the risk of extinction.

For example :

Fish which is source of food, due to its increasing demand its number is declining.

3- Loss of Habitat

Mostly biodiversity lives in forest and in order to fulfill wood and food demands, these forest are being cutting due to which biodiversity is declining.

4. Wildfires :-

Due to extreme weather conditions, wildfires have become a common occurring phenomena.

In 2023, wildfires of Canada resulted in the migration of 20,000 people and 26000 hectares of land was scorched.

(Source - TRT News, 2023)

5. Floods :-

Due to extreme weather weathers, the upper layer

of water becomes warm which move away and to refill it the water from lower surface move upward. This results in larger water waves which causes floods in low land areas (coastal areas).

In 2022 Floods came in Pakistan which caused a loss of \$30 bn.

Major effects:

- ① Displacement of people
- ② Loss of Cattles
- ③ Loss of Agricultural products

Convention on Biodiversity loss

The convention on Biodiversity loss was adopted in 1992 at Rio Summit.

Objectives:-

- ① Conservation of biodiversity
- ② Sustainable usage of it
- ③ Share its benefits fairly and equitably.

Scope :-

It covers all :-

- ① ecosystems
- ② Genetic resources
- ③ Species

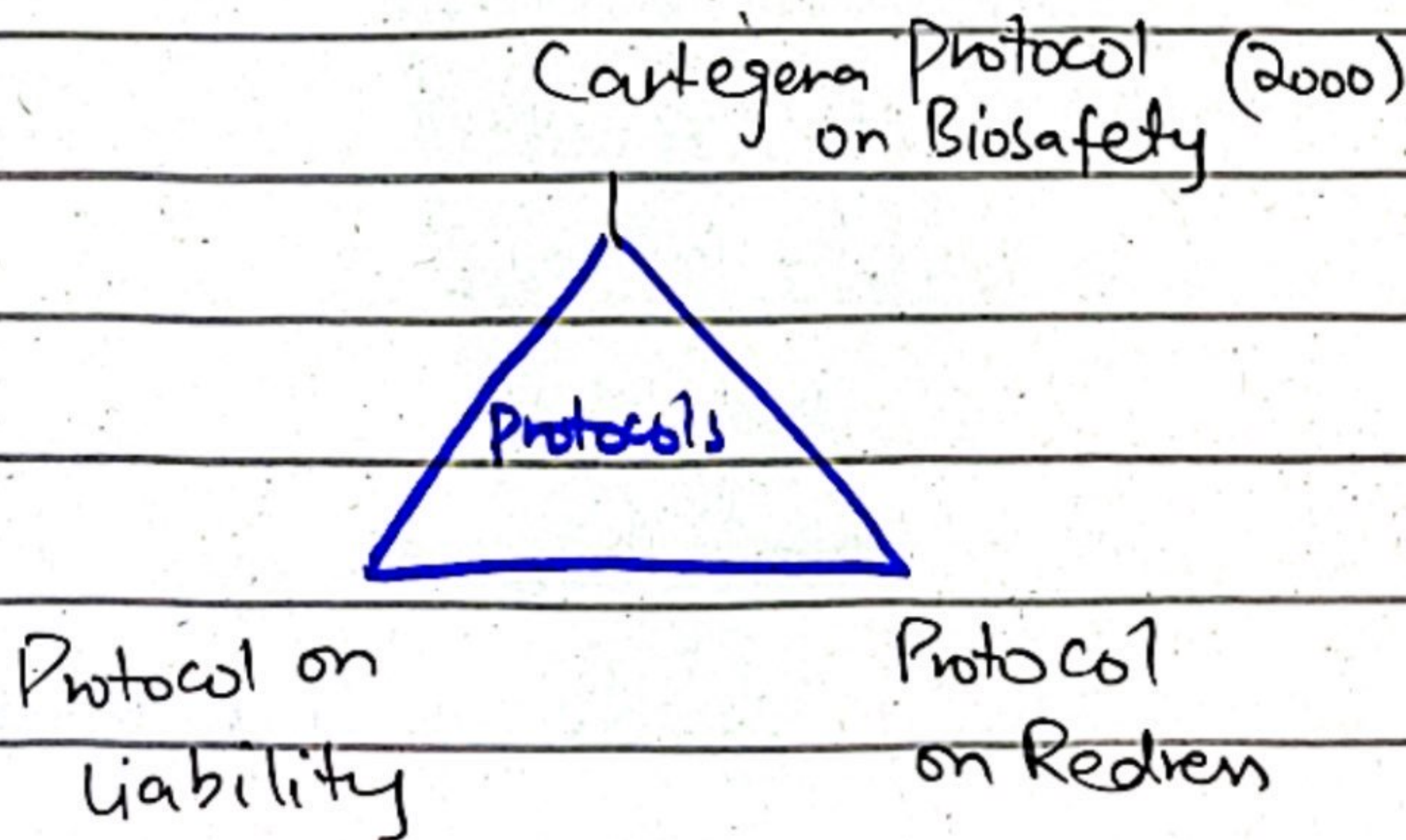
except human genetic resources

Principles :-

- ① Biodiversity is unequally distributed throughout the universe so all nations must work together to preserve it.
- ② The developing countries must work in collaboration with developed countries to preserve biodiversity.

Protocols :-

Three protocols of CBD are :-



Participants :-

196 countries are participants of CBD, except Four United-Nation member states.

UN convention on Biological diversity

Theme of 2024 Biological Convention is
"Be part of plane"

In COP 15, an agreement was adopted to conserve 40% of land around coastal areas of the world.

Implementation of CBD :-

- ① The participants must include Biodiversity agenda in their national Decision Making.
- ② The Stakeholders must monitor the biodiversity changes.
- ③ All the stakeholders must Preserve the indigenous conservation practices.

(b) African region faces desertification. What are the causes and effects of desertification?
↳ Shed light on UN convention on desertification.

Desertification :-

"Desertification is a process in which fertile land is converted into infertile land due to natural and man-made reasons."

Desertification in Africa :-

Almost 45% of land in Africa has been converted into desert and 55% is at risk of desertification. The regions in north of Africa are hyper-arid, while central Africa are humid.

Desertification is a major challenge for Africa but to world crisis like Israeli - Palestinian conflict, Ukraine - Russia

conflict, the issue has been suppressed.

The UN Food And Agriculture Organization states that;

"Africa will loose 2-3rd of its arable land into desertification by 2030 if desertification is not stopped."

Causes of Desertification

① Overgrazing :-

Overgrazing is one of the major reason of desertification.

- The hooves of animals pressurized land and the soil pores closes so water instead of percolating in soil, flow over the surface.

- Similarly, by overgrazing the grasses natural ability to grow is lost bth because of nutrients loss.

② Drought :-

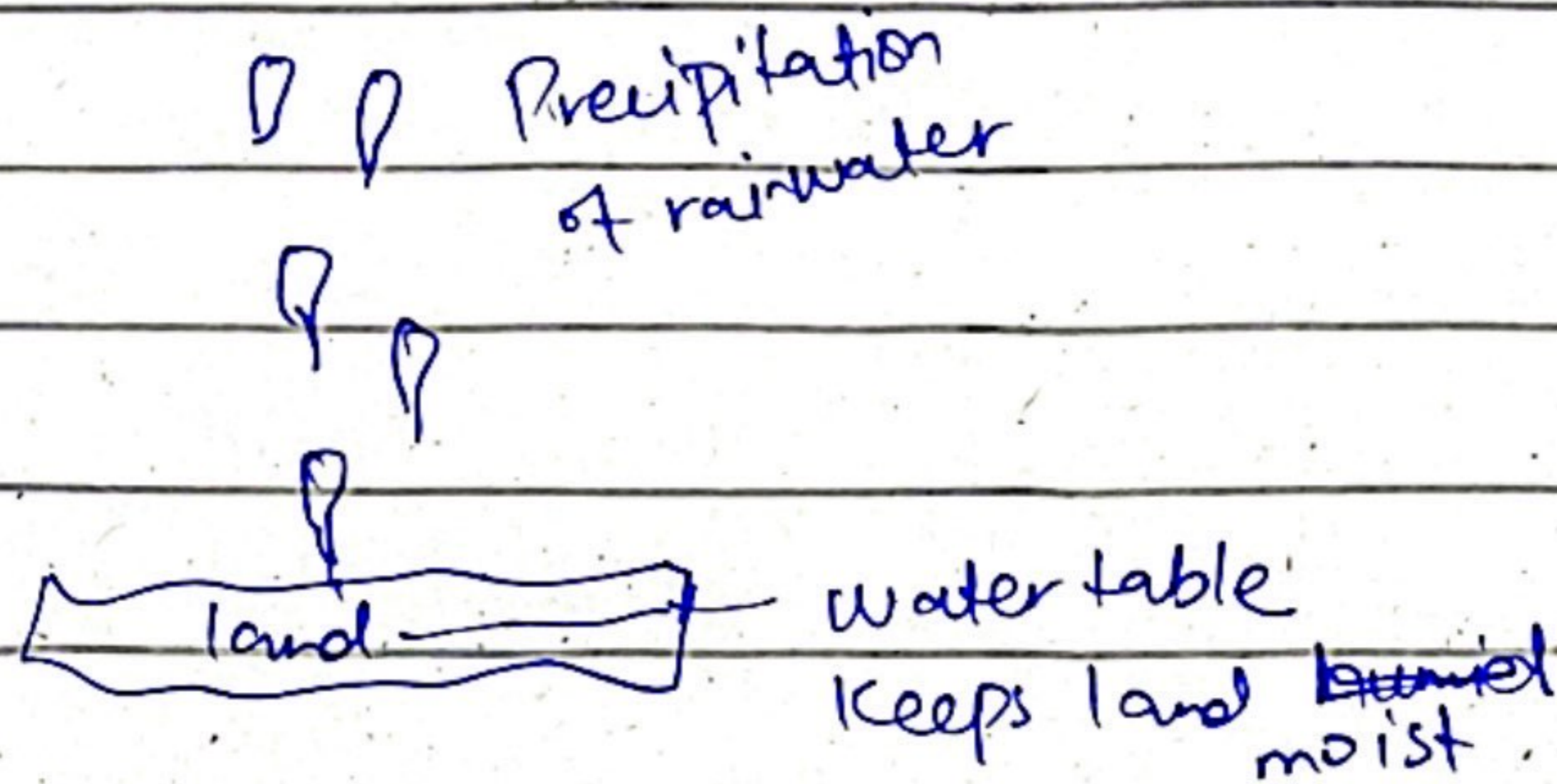
Drought is another reason of desertification. Because when for longer period of time there is not water precipitation, the land will become barren. Due to drought, the River Euphrate has ^{been} dried.

③ Inappropriate practices of Agriculture :-

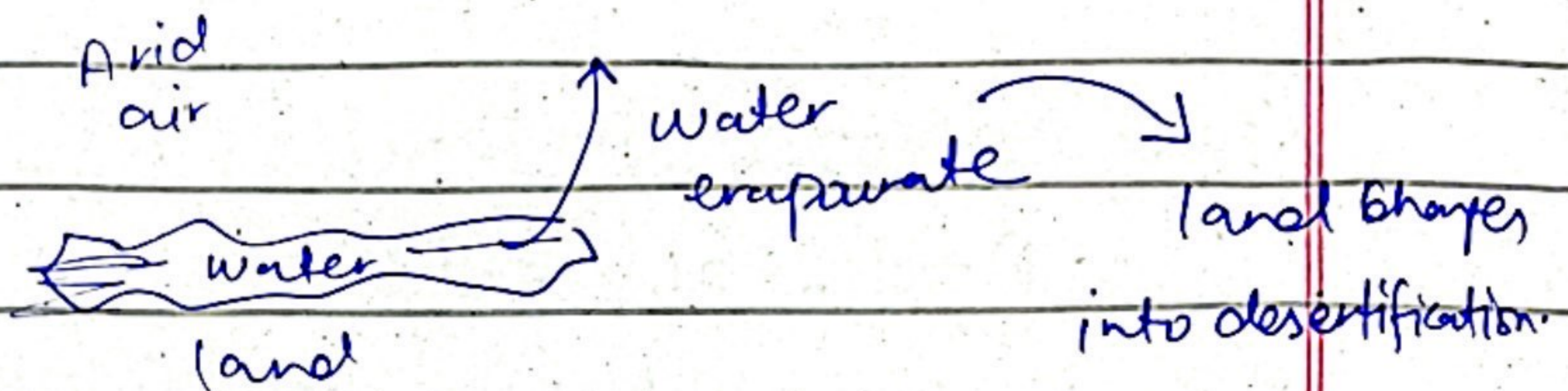
Due to inappropriate practices of agriculture the underground water has driven out. Now there is scarcity of water in South Africa and other African states.

④ Climate change

Climate change is another reason of desertification. Because extreme heat waves and high temperature result in the loss of humidity in air.



But when no rain and extreme heat waves



⑤ Population Explosion :-

After Asia, Africa is the 2nd largest continent with respect to population. But due to drought, people can't fulfill their food needs. Due to over-population the supply of water has increased so the water table has driven out which has resulted into loss of desertification.

Effects of Desertification

Effects of desertification are many and these are severe in nature.

① Forced migration :-

People are migrating from Africa to Europe and Middle East. Due to the natives of that region also reject them because of culture phobia. It has driven the entire world towards instability.

② Food Insecurity :-

The food security is maximum in African states.

According to FAO, Report 2023, the poverty is maximum in African region.

Due to drought in Somalia almost 50,000 people have been killed.

Loss of Biodiversity:-

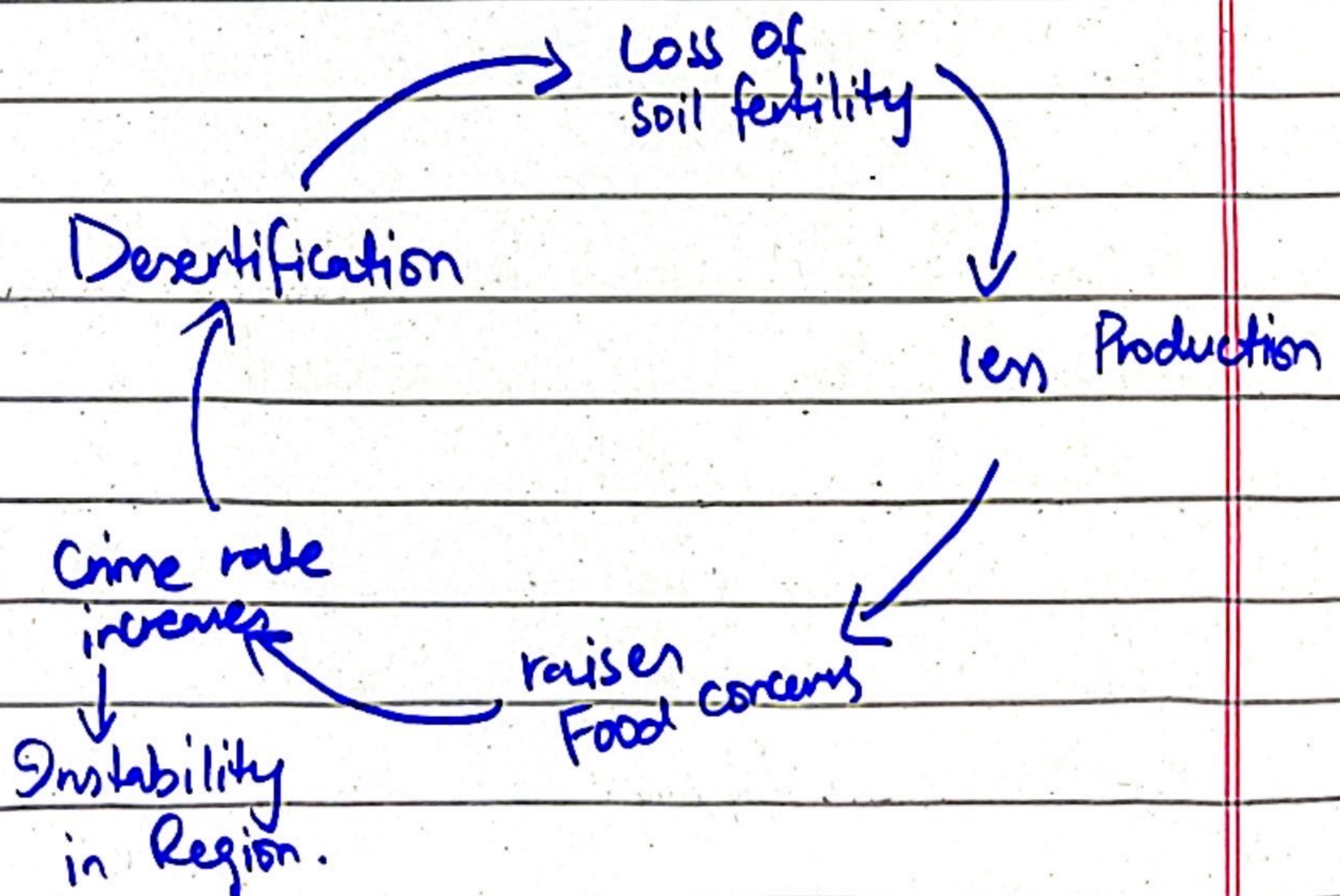
Due to desertification there is a major risk of loss of biodiversity. Many African species have migrated to other continents.

Example

Parthenium Plant

Loss of fertility :-

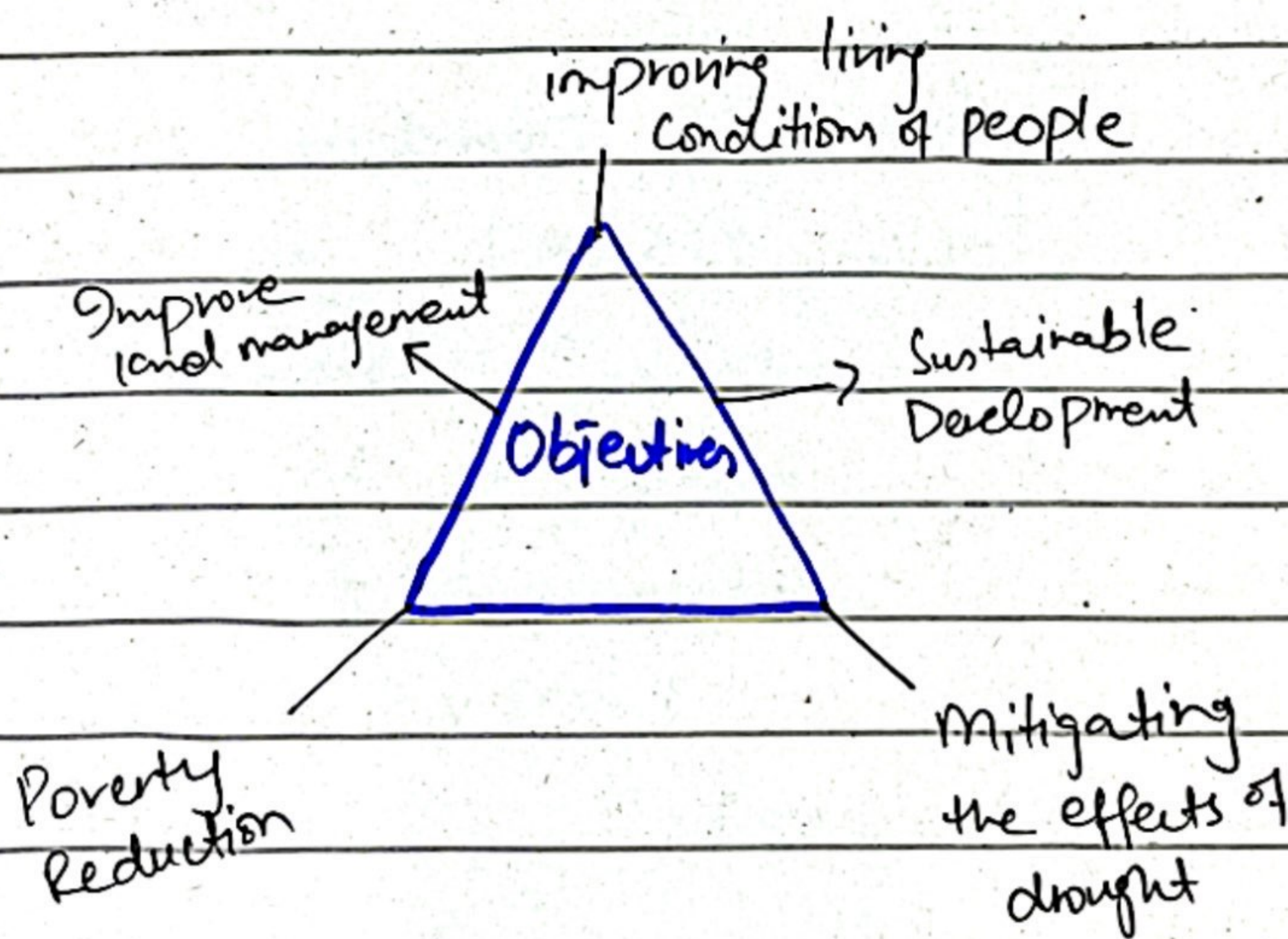
Desertification results into loss of nutrients which make land infertile to grow plants. And it finally raises food concerns in society.



UN convention on desertification

The UN convention to combat desertification (UNCCD) is an international agreement that aims to reverse land degradation.

It was established in 1994 and is the only legally binding framework that addresses the effects of drought and desertification.



In 2015, the participants adopted **LDN** (Land Degradation Neutrality) as a primary goal of UNCCD.

And its main objective is to halt land degradation by 2030.

The theme Chosen for this Year's Desertification and Drought Day (DDD 2024) is "United for Land: Our legacy. Our Future" and its aim is to mobilize all parts of society for sustainable development.

Q.3(a) Industrial revolution paved the way.....

Industrial Revolution paved the way towards socio-economic progress:-

In 18th Century, Industrial Revolution started in the world and it directed world towards socio-economic progress in the following ways:-

- ① Improved living standard
- ② Increased productivity
- ③ Scientific inventions
- ④ Economic prosperity

Base of Industrial Revolution:-

Base of this revolution was coal and oil. World shifted

towards coal and oil based

(1) Industries (4) Transportation

(2) Power Plants.

(3) Agriculture

Now, the question is how these sectors have deteriorated the environment in 21st Century.

Emissions from Industries

The emissions from industries vary depend on production process as well as carbon dioxide is permanently adding to atmosphere because of burning of coal.

According to Environmental Protection Agency, of USA

Emissions from Industries are the third largest emissions.

Major Gases from Industries

Carbon dioxide

Carbon monoxide

Oxides of nitrogen

Oxides of sulphur

Power Plants

Manimum en electricity started to generate from oil, which left serere consequences on our atmosphere.

From industrial revolution to present, about 3 trillion ton Carbon has added in the atmosphere.

Agriculture

With Industrial revolution, agricultural revolution also occured, Farmers started to utilize :

① Fertilizers

② Oil to drill water from land.

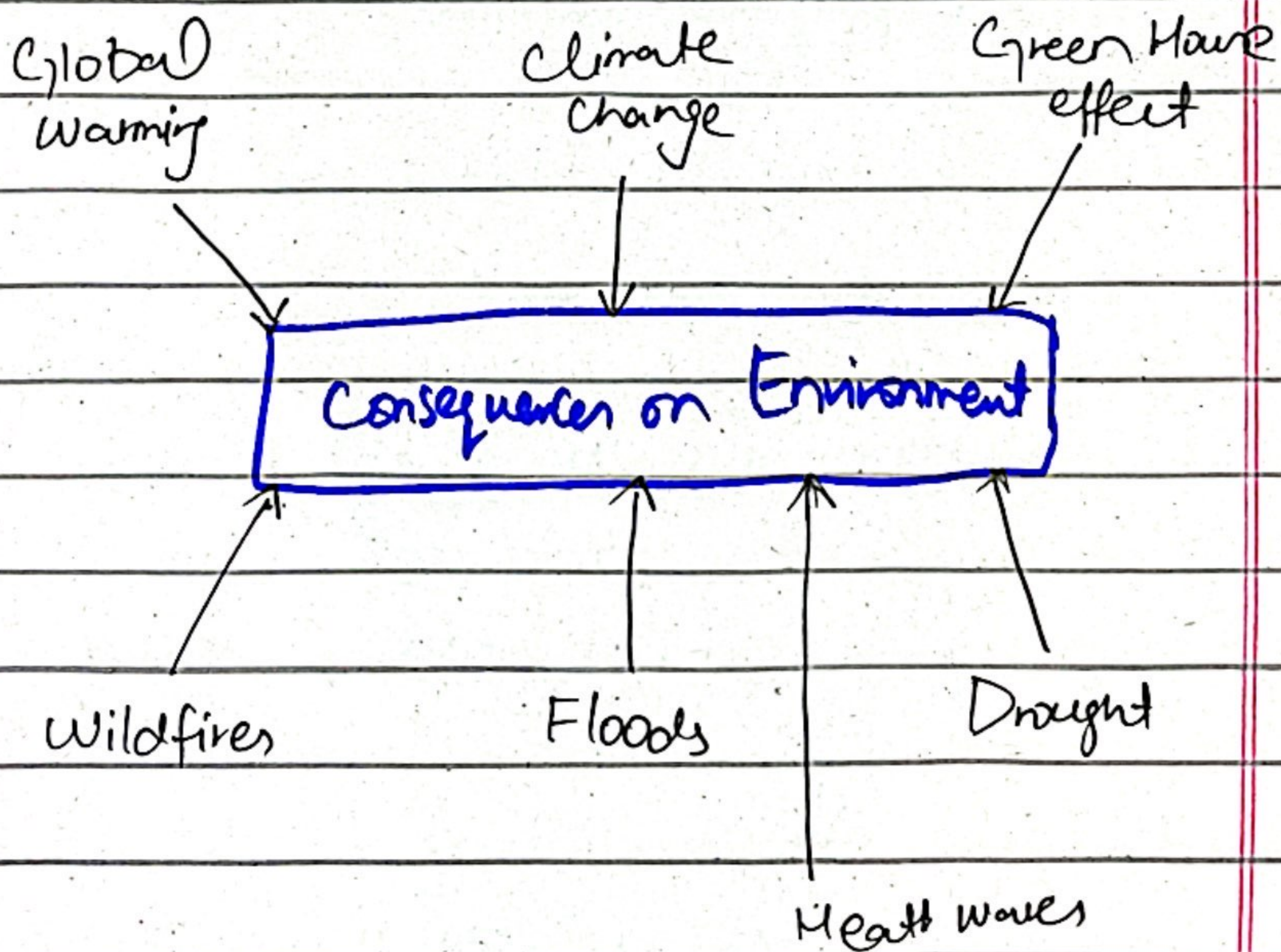
These added pollution to atmosphere, as well as damage the a water quality of lakes, streams and rivers. So the level of clean water has deteriorated to such an extent, that we are unable to drink it.

Transportation

Along with industrial revolution, new inventions were made, the transportation sector also flourished. Motor cars, motorcycle and other vehicles were invented. These vehicles add pollutants directly into atmosphere.

Consequences on Environment

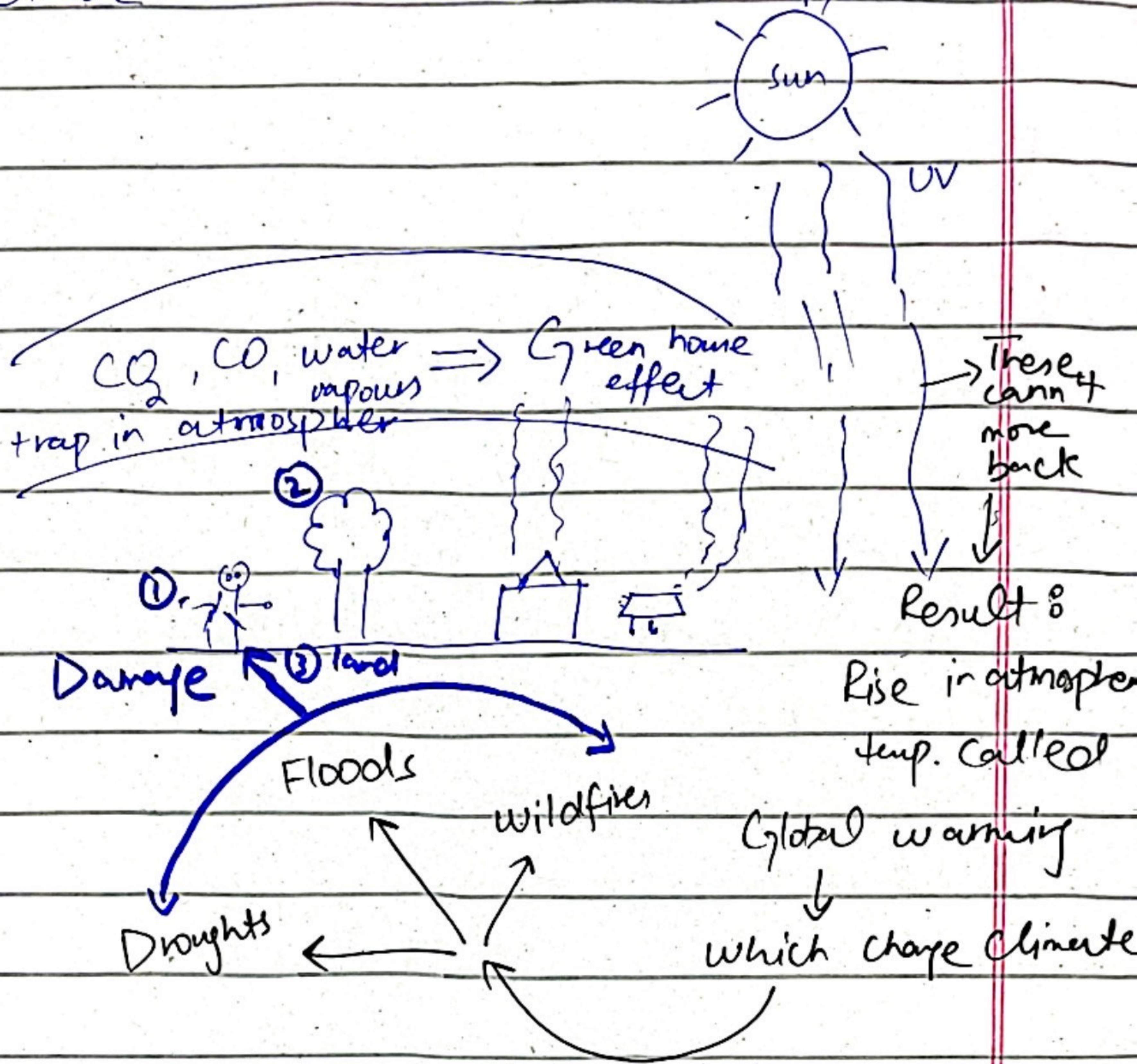
All these developments have major consequences on environment.



Green House Effect :-

Gases like Carbon dioxide, Water vapours,

methane are accumulated in atmosphere.

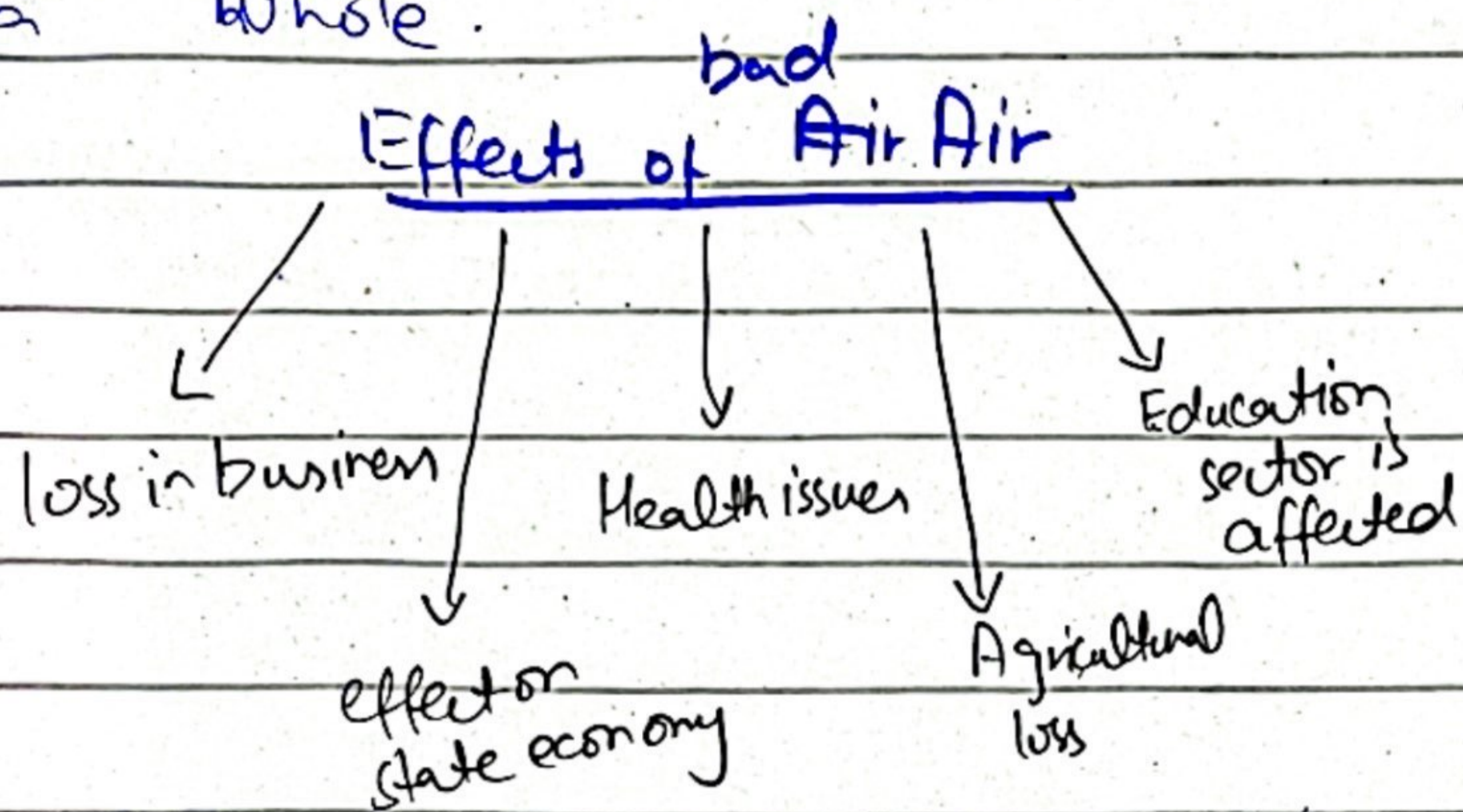


(b) Pakistan is witnessing bad air quality index

The air quality index of Pakistan is 168 poor among world countries. And the in major cities of Pakistan like Lahore, Peshawar it is worst. Lahore is at 9th Rank while Peshawar is at 5th Rank in Asia, according to

South Asia Journal.

Such a bad air in its major cities has severe effects on people and society as a whole.



Factors behind bad air :-

① Industries :-

Lahore is an industrial city and the emissions from factories have deteriorated its atmosphere and there is no proper mechanism to counter it both at National and individual level. Which has placed the city under high threat.

According to World Bank report, The Bad Air Quality Index has placed the ^{life in} Big cities

seven times less expectancy²⁹

Vehicle Vehicular Emissions :-

2nd major factor is emissions from vehicles, more than 15 million vehicles are in Lahore. Which emit poisonous emissions like lead, SO_x , Carbon dioxide directly into atmosphere.

Household Emissions :-

Around 60% households in Pakistan use solid fuels for cooking, which is a major contribution to poor air quality.

Agriculture Smoke :-

In Pakistan, there is old practice of burning the land waste which add carbon dioxide to atmosphere so the quality of air has been deteriorated.

Way Forwards :-

Use Euro-Fuel technology :-

Fuel which has less deactivating chemicals than normal fuel. It will add less pollutants to atmosphere.

Plant Increase Green Cover :-

Plant more trees, so that excess carbon is absorbed by trees from atmosphere.

Use Public Transport :-

Give general awareness to public and special laws must be formulated to increase public transport usage rather than private vehicle.

Improve Building Infrastructure :-

In Asia, mostly households are constructed in such a way that there is no proper ventilation structure

So, building structure must be revised.

Shift towards renewable energy resources :-

And the most efficient way is to shift from non-renewable energy resources to renewable energy resources.

Q.4 what is climate? ...

Climate :-

The weather conditions prevailing in an area over a long period of time is called climate.

Weather variables :-

These are variables that describe the weather at a given time and location

There are 6

Temperature :- Hot or cold,

Air Pressure :- The weight of air in surrounding

Humidity : The ^{water vapours} moisture in atmosphere

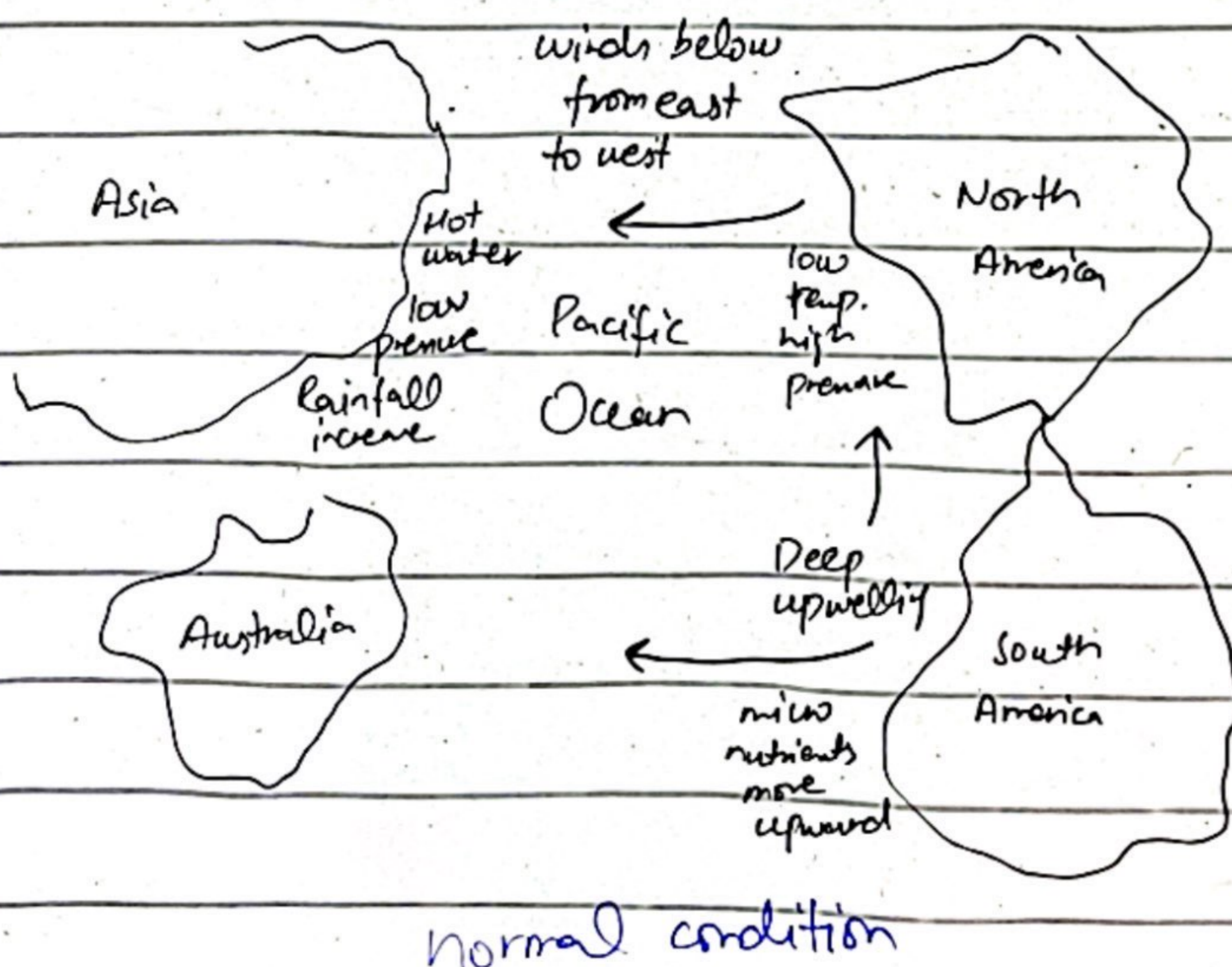
Wind : The speed and direction of wind

Precipitation : Rain, Snow

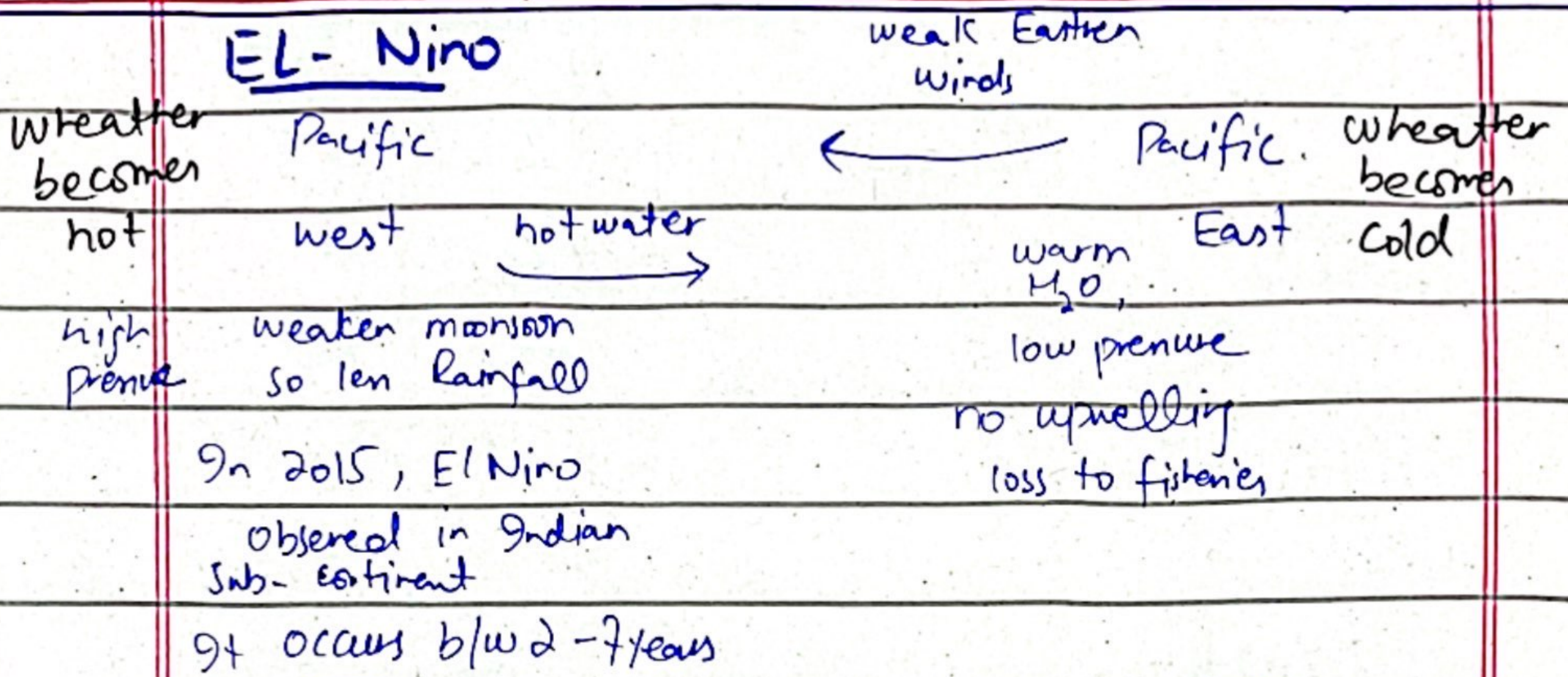
Cloud formation : The amount of clouds in the sky.

La-Nina and EL-NINO phenomena in context of global climate distribution.

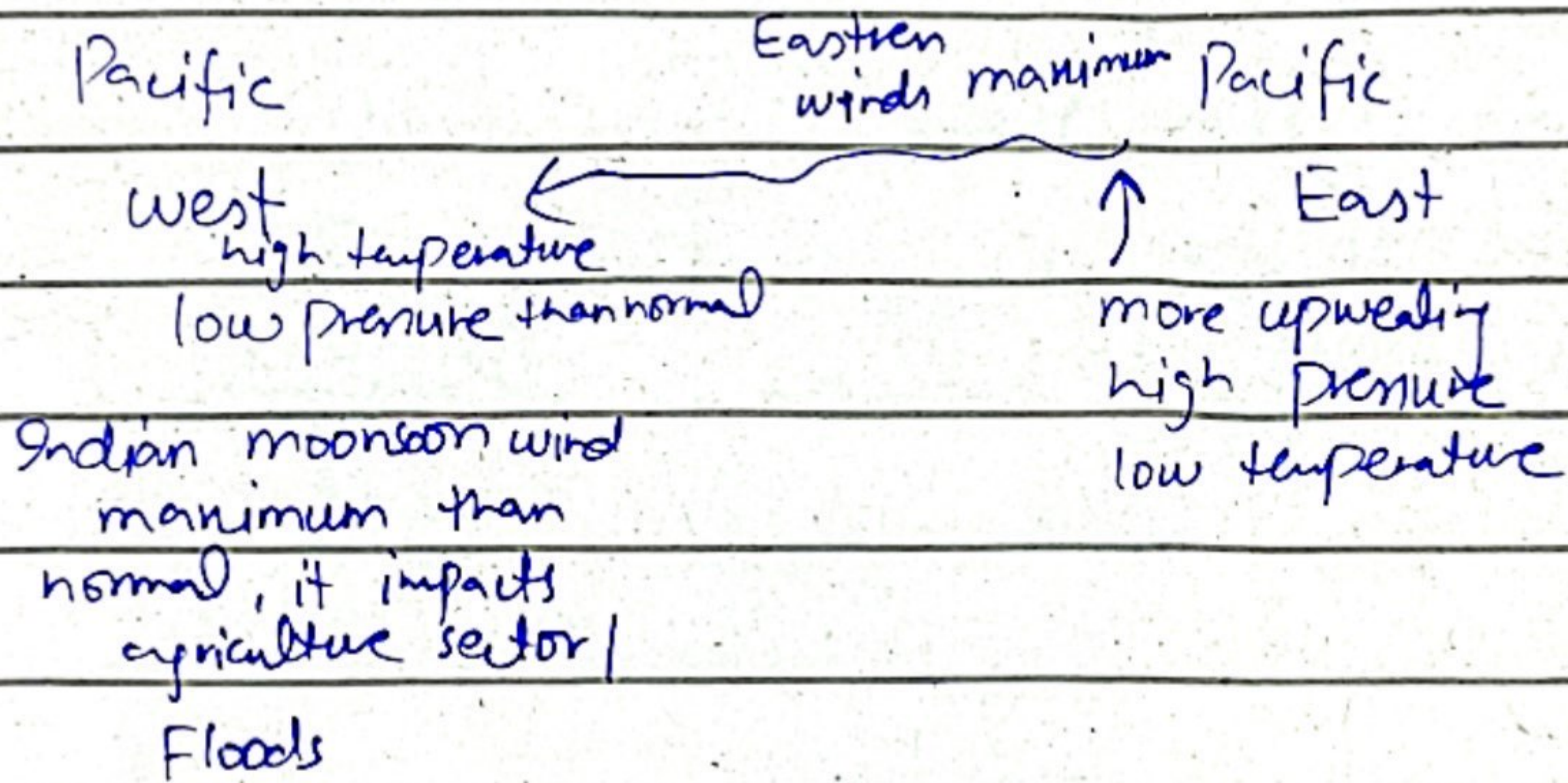
These periodic weather patterns occur as a result of fluctuating ocean temperatures.



EL-Nino



La-Nina = opposite to El-Nino



Global Climate Distribution

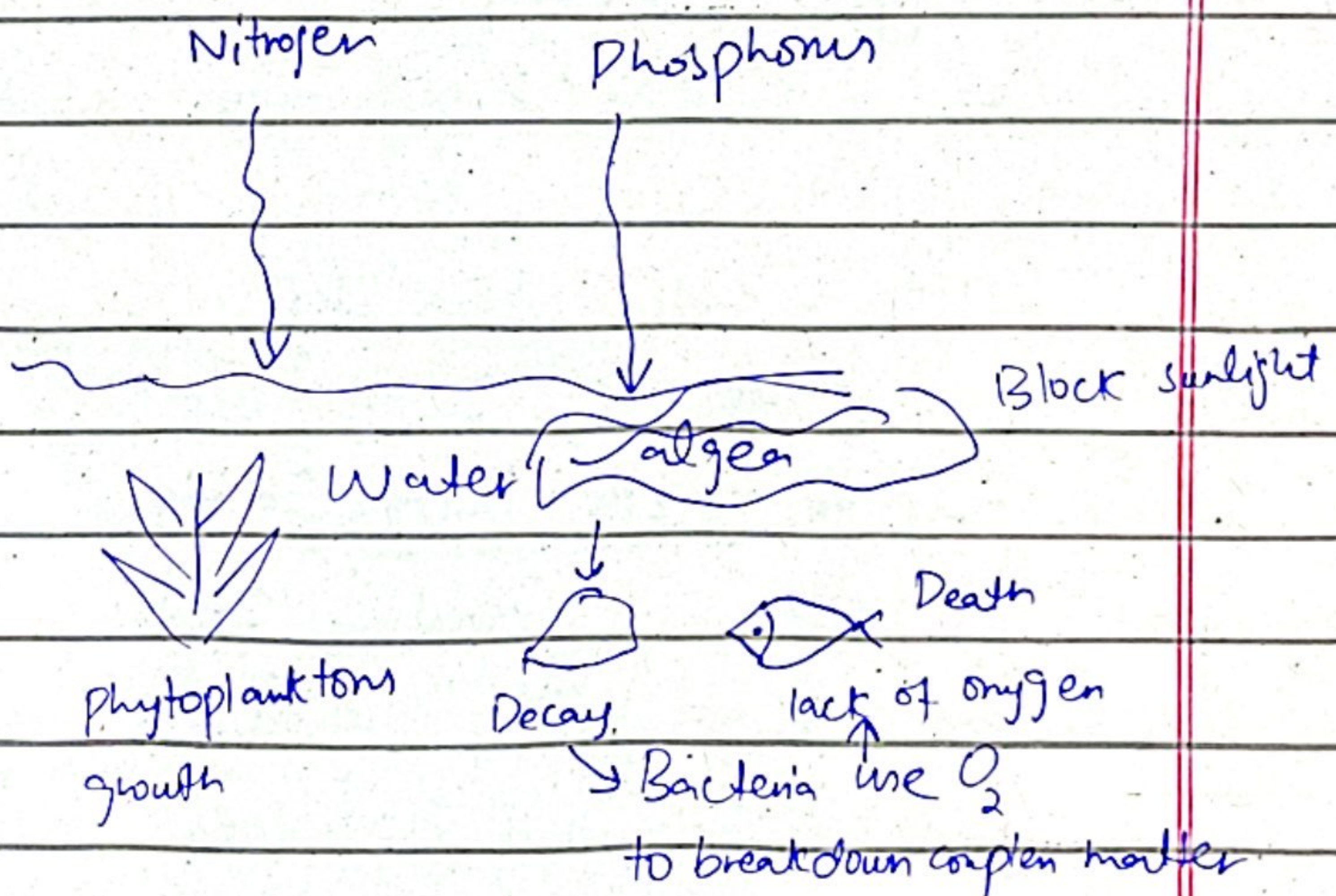
- During EL-Nino phenomena, Indian Continent and Australia hit with warm weather and drought. And there is flooding in Northern South America.
- While during La-Nina phenomena bring increased rainfall to Australia and Southeast Asia and it can spark drought and wildfires in eastern Pacific region mainly Southwestern US and Mexico through to South America.
- Other region like Africa remain moderately affected.

(b) Define Eutrophication. . . -

Eutrophication:

Eutrophication is a process that occurs when body of water becomes enriched with nutrients, which lead to excessive growth of algae and plants.

Process of Eutrophication



Types of Eutrophication

① Natural eutrophication :-

A natural process that occurs

in centuries due to pile up of nutrients in ocean surface.

2. Man made Eutrophication

It occurs due to human activities like :

- (1) Discharge of fertilizers
- (2) Sewage discharge
- (3) Industrial discharge

effects of Eutrophication

(1) Algal Bloom

Dense bloom of algae can reduce water clarity and harm water quality.

(2) Effect on Food Chain

It affects food chain because of algal growth, oxygen supply to fish reduces, they will die so it disturbs food chain.

(3) Ocean Acidification

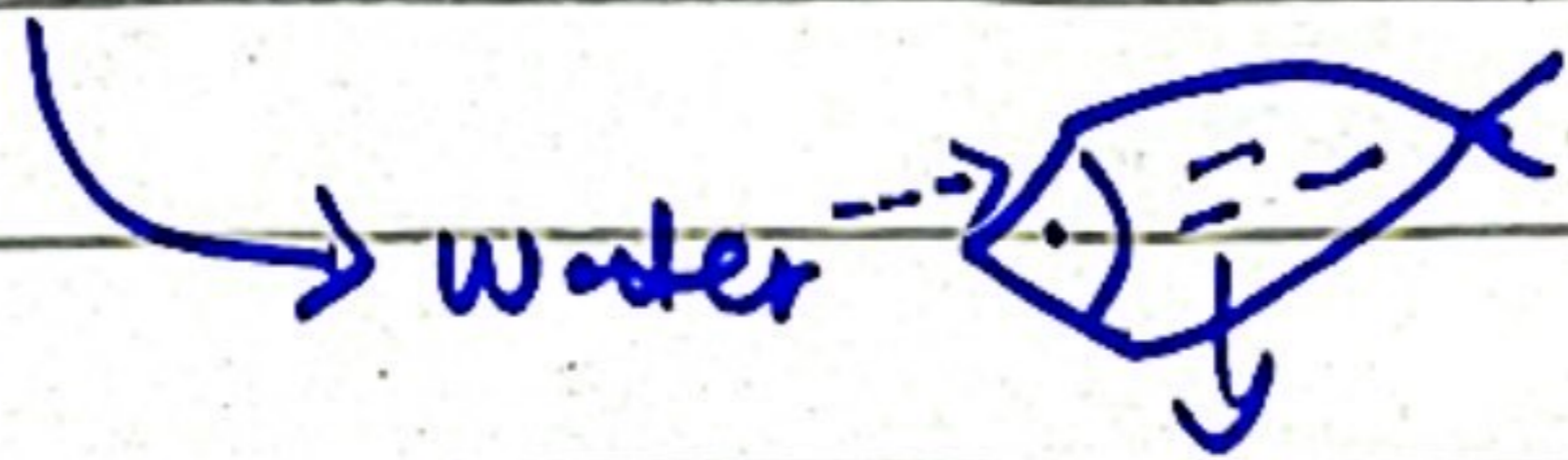
The decomposition of algae

and plant produces CO_2 .
So the PH of water changes
and it becomes acidic.

Tonic Substances :-

Eutrophication add tonic
substances to the atmosphere
water.

Tonic substances
like Pb, Aluminium



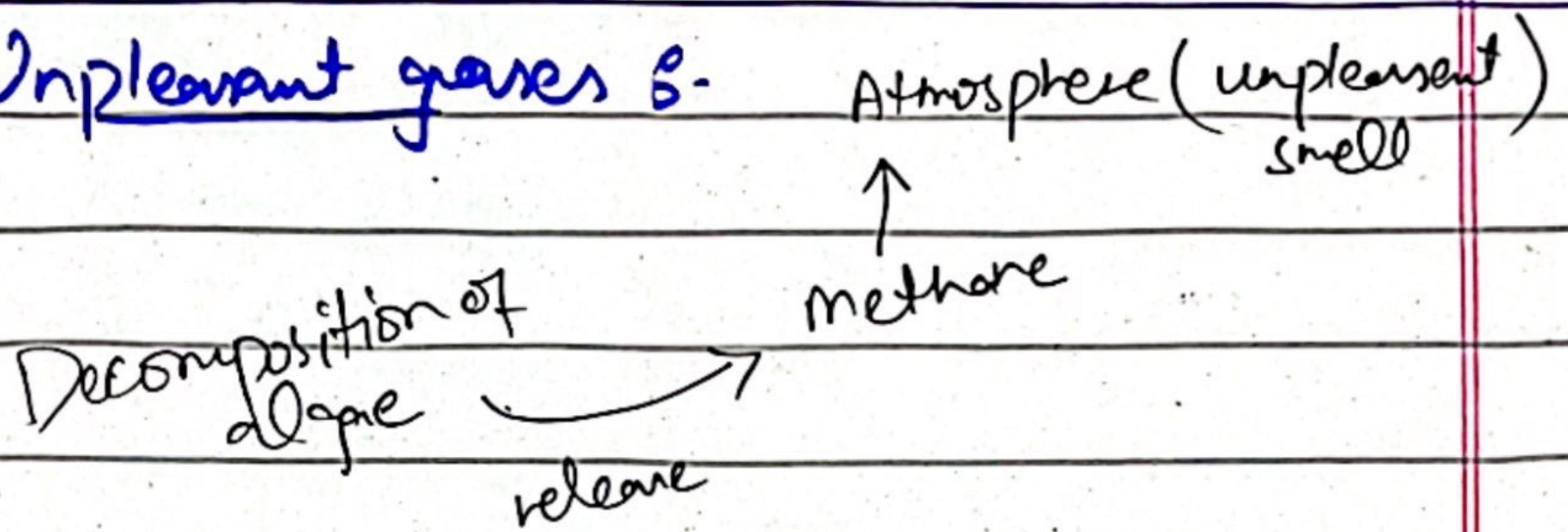
gt clogs Fish
gills \rightarrow death

Health Problems :-

Water quality damages
when humans eat such
water, they will have
health diseases like

- ① Typhoid
- ② Malaria
- ③ Dysentery
- ④ Cholera

Unpleasant gases :-

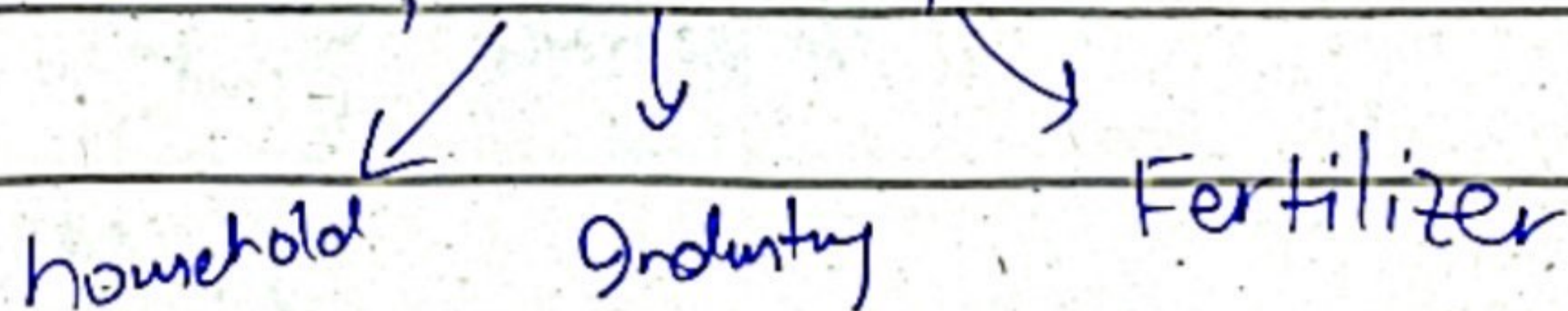


Controlling Measures :-

① Water Treatment before disposal :-

Before disposal into water

water bodies, water from



must be treated, so that hazardous chemicals can be removed, this is a way to prevent Eutrophication.

② Use Biological techniques :-

Use wetlands, which can nitrogen fixing bacteria like Azotobacter to lessen Nitrogen concentration in water, through which Eutrophication can be avoided.

(12)

(3) Remove enriched Sediments :-

Enriched Sediments like magnesium and phosphate must be removed by other restoration methods.

(4) Chemical Treatment :-

Use chemical coagulants like lime, magnesium sulfate to treat water.