



JG College of Commerce

B.Com. Sem-4

Course code: FC 202B - Pollution Control and Its Impact

Syllabus of Gujarat University

SYLLABUS FOR --- B.COM.

SEMESTER IV

Course Code: FC 202 B

NAME OF THE COURSE: POLLUTION CONTROL & ITS IMPACT

Unit I

Impact of industrialization and modernization - pollution and pollutants... Air pollution and its effects - air pollution - sources - pollutants – organic and inorganic pollutants - gaseous pollutants– nitrogen oxides - particulate pollutants - effect of pollutants on plants – animals and human beings - photochemical oxidants - photochemical smog – acid

Rain - Green house effect - ozone depletion - global warming -Environmental pollution techniques for air pollution - monitoring and Control measures of air pollution - dust control equipments - Electrostatic precipitators and scrubbers

Unit II

Water pollution and its effects structure - water pollution - sources -Pollutants - industrial effluents - domestic wastes - agrochemicals -Heavy metals - effect of pollutants on plants - animals and human beings Body - Eutrophication - waste water treatment - indicator organisms -Oxidation pond - water pollution analysis and monitoring – drinking Water standards.

Soil pollution and its effects - soil pollution - sources - solid waste Disposal and their effects - pesticides - types and effect of pollutants on Plants - animals and human beings - biomagnifications - fertilizers and its Effect of pollutants on plants - animals and human beings - soil pollution Control measures - soil microbes and function - biofertilizer.

Noise pollution and its effects - noise pollution - sources – noise Exposure level and standards - impacts - noise control and abatement Measures.

Unit III

Marine pollution - sources and control of marine pollution – criteria Employed for disposal of pollutants in marine system – coastal Management.

Radioactive pollution and its impacts - radioactive - sources - effect of Pollutants of plants - animals and human beings - prevention and control Measures of radioactive pollution

Unit IV

Assessment and control of pollution - environmental standards - Assessment of pollution effects due to air - water - soil and radioactive Pollution - biotechnology in pollution control - microbial role in Pollution control - biomonitoring and bioremediation - pollution control Legislations for air - water - land etc.

Biotechnology in pollution control - bioremediation (organic and Inorganic pollutants) - bioleaching and biomineralization.

UNIT: 1

Q: 1 What is pollution? Explain the causes and impact of air pollution.

Pollution is the effect of undesirable changes that occur in our surroundings that have harmful effects on plants, animals and human beings. To gain short term economic goals at the cost of long-term ecological benefits such activities are incurred. Mankind is the greatest enemy of the eco cycle on the earth. During the last few decades, we have contaminated our air, water, land and other natural resources. According to a survey, in 2015 pollution killed 9 million people worldwide. Pollution restricts economic growth and aggravates poverty and inequality in both rural and urban areas.

Types of Pollution:

1. Air pollution
2. Marine Pollution
3. Noise Pollution
4. Water Pollution
5. Thermal & Radio-active Pollution
6. Soil Pollution

Pollutants are known as harmful substances that have undesired effects or make places unfit for living. With the help of nature and concentration of pollutants we can determine the severity of its detrimental effects on human health. Pollutants that enter in water have the ability to spread to distant places especially in the marine ecosystem which affects aquatic animal life adversely.

Air Pollution:

Air pollution refers to a significant increase in the level of harmful gases, solids, or liquids present in the atmosphere which affect humans, other organisms, buildings, monuments, etc. Air pollution is the largest environmental killer. Air pollutants can be categorized as primary and secondary. The key primary air pollutants include: black carbon, Sulphur oxides, nitrogen oxide, ammonia, carbon monoxide, methane etc. The secondary pollutants are produced by chemical reactions in the air, which include ozone, sulfuric acid and nitric acid, Nitrogen dioxide etc. Basically, air pollution has increased due to industrialization. The air may become polluted due to some natural causes such as volcanoes or forest fires. In India, the monument- Taj Mahal is affected a lot due to air pollution which is caused by Sulphur dioxide.

Causes of Air Pollution:

- 1) **The Burning of Fossil Fuels:** When fossils are burnt, it releases 6 hazardous products in large amounts in the air which are Carbon dioxide, Carbon Monoxide, Sulphur dioxide, Nitrogen oxide, Lead, Particulate matter. The use

of fossil fuels creates 80% of the world's energy. Burning fossils of fuels is the main cause of air pollution. Fuels like; coal, oil, gasoline are used to produce energy for electricity or transportation. It increases the level of carbon monoxide which has adverse effects on the atmosphere.

- 2) **Industrialization:** Due to industrialization the environmental degradation has occurred. As a result of highly polluted industries dust, smoke, fumes and toxic gas emissions have occurred. Thermal power plants, coal mines, cement, sponge iron, steel plants, petroleum and chemicals etc. are examples of highly polluted industries. Industrial pollution occurs due to lack of efficient environmental policies, unplanned industrial growth, use of outdated technologies, inefficient waste disposal, high use of natural resources etc.
- 3) **Transportation:** In urban cities, vehicle pollution is the major cause of air pollution. It is said that when a car burns gasoline, it emits pollutants in the air. Transportation burns most of the world's petroleum. Aviation, road transport, shipping are the main sources of transportation which burns fuel in a large amount. The high vehicle pollution creates holes in the ozone layer which causes various health issues.
- 4) **Agricultural activities:** Now-a-days in agriculture pesticides and fertilizers are used in high quantities, for quick growth of the crops and vegetation. When such products are used the frequent by-product-ammonia mix up with the air which is one of the most dangerous gases in our environment.
- 5) **Deforestation:** Forests act like sponge's carbon dioxide. When forests are burned or destroyed on purpose the protection against carbon dioxide is removed which increases the amount of carbon dioxide in the air.

Impact of Air pollution:

- 1) **Global Warming:** It is the most hazardous and serious complication associated with air pollution. Global warming means continuous heating of Earth's climate system. Due to liberalization of greenhouse gases (methane, carbon dioxide) increases the temperature of the atmosphere which causes global warming. Due to global warming ecological balance and human health both adversely affect. Melting glaciers, snow capped mountains, increase in water level in rivers and seas, floods are the worst impacts of global warming.
- 2) **Acid rain:** Acid rain contains harmful amounts of nitric and sulfuric acid. Industries often release nitrogen and Sulphur gases into the environment which mix up with water vapors known as Acid rain. It has various health and natural dangers. Erosion of monuments and buildings, acidic soil, reduction in biodiversity and other human health issues like cancer, skin disorder, etc. occurred due to acid rain.
- 3) **Smog:** Smog is a form of intense air pollution. Smog reduces visibility. There are two types of smog – Photochemical and Sulfurous smog. Such pollution occurs due to nitrogen oxides, sulphur oxides, ozone, smoke and other particulates. Smog formed by chemical reaction between pollutants, sunlight, ozone and other unburnt hydrocarbons. It is very toxic to humans as well as

plants. Due to leaded fuel, industrial emission, vehicular emission, coal combustion emission, forest and agricultural fires smog has occurred. Use of renewable energy sources, reduction in the number of vehicles, smog problem can be tackled.

- 4) **Depletion of the ozone layer:** The main object of Ozone layer is to protect humans from harmful ultraviolet (UV) rays. Gradual thinning of the ozone layer is called depletion of the ozone layer. Rise in chlorofluorocarbons, hydrochlorofluorocarbons in the atmosphere results in depletion of the ozone layer. As the ozone layer becomes thin, it will discharge harmful rays back on earth and can cause skin and eye-related problems.
- 5) **Effect on Wildlife:** Animals also suffered from air pollution. Toxic chemicals can force wildlife animals to migrate to another place which changes their - habitat. Due to acid rain the aquatic life may also be adversely affected.

UNIT: 2

Q: 1) Explain Noise Pollution.

Ans: According to the World Health organisation sound frequency is less than 70 db. (decibels) are not damaging to living organisms, regardless how long or consistent the exposure is. Not all sound is Noise. Noise pollution refers to unwanted or excessive sound that can have harmful effects on human health, wildlife, and environmental quality. In other words, when pollutants contaminate the environment which becomes a nuisance and has an adverse effect on a person's mental ability is called noise pollution. Calcutta, Delhi and Mumbai are included amongst the noisiest cities in the world. Sound is measured in decibels (db.). It is a logarithmic scale. For example, a change from 40 db. to 80 db. represents a 10,000-fold increase in loudness. When the sound level reaches 140 db., our ears hurt. Long exposure to noise even at 85 db. can cause hearing loss. We should also differentiate plain noise and meaningful noise. Delhi based National Physical Laboratory has observed that noise generated from firecrackers is much higher than the prescribed level. The effects of such noise can range in severity from being extremely annoying to being extremely painful and hazardous.

Noise pollution affects millions of people on a daily basis. There are several sources of noise pollution such as;

- Street traffic sounds from vehicles – cars, buses, pedestrians etc.
- Air traffic
- Loud music near commercial venues
- Train station traffic
- Industrial sounds like; mills, generators, compressors etc.
- Noise from fireworks, firecrackers, loudspeaker
- Construction noise

The difference between sound and noise is subjective in nature. As per Environment Protection second amendment Rules, 1999 the permitted noise level is 125 db.

Effects of Noise pollution:

Effect of Noise pollution Physical Health: Due to excessive noise physical damage may cause such as temporary or permanent hearing loss which is called as 'temporary threshold shift (TTS)'. Due to this condition people are not able to recognise weak sounds. However, it will recover within the month. Permanent hearing loss is usually called "Noise-induced permanent threshold shift (NIPTS)". The person gets no recovery from such disease. About 50% of the people exposed to 95 db. sound level at the workplace develops syndrome of NIPTS and if people are exposed to more than 105 db. experience permanent hearing loss. Man-made noises such as jackhammers, horns, machinery, airplanes, and vehicles can be too loud for our hearings. Noise pollution can also cause headaches, high blood pressure, respiratory agitation and even heart attack in some cases. Noise pollution also affects people's ability to focus and brain responses.

Effect of Noise Pollution on Mental Health: Noise can also cause emotional or psychological effects such as anxiety, stress, sleeping disorder and irritability. Due to noise, mental fatigue and lack of concentration problems may be seen amongst human beings. According to research it is observed that the schools which are situated in busy areas of the city and suffer from noise, the performance of that school student is poor in comprehensive tasks. In the US textile mills are not allowed to exceed 100 db. for more than two hours whereas in India mills run three-eight hours shifts. Due to industrial noise pollution efficiency and productivity of the workers may also decrease.

Effect of Noise Pollution on Environment: Noise pollution can have an adverse impact on the environment. It has a harsh effect on marine life. Noise travels around five times faster in water than on land. The "seismic survey" is one of the most devastating man-made sounds in the ocean. This process is done to obtain fossil fuels. It is conducted with the help of drilling machines which are louder in nature. Due to such pollution the animals also suffered from hearing loss. Noise can cause serious damage to wildlife especially in remote regions. Masking is the worst impact of noise pollution on animals where they are not able to hear important environmental cues and signals.

Noise Controlled Technique:

There are four fundamental ways through which we can control noise pollution such as sound insulation, sound absorption, vibration damping, and vibration isolation. In Industries with the help of rigid sealed enclosures the loud sound of machinery can be reduced. Isolating machines and their enclosures from the floor, using special mounts and using flexible couplings for interior pipelines also helps to reduce noise pollution in industries. On construction sites the noise can be

reduced by using proper construction planning and scheduling techniques. Noisy equipment should site as far as possible from workers and residents which reduces noise level by 50%. Vehicles make too much noise so as to avoid that the limit of sound should be banned from playing on the main routes in residential areas. With help of sound barriers, limitation of vehicle speed, change in road surface, traffic control measures, and change in tyre design the vehicular noise can be reduced. To avoid loud noise of aircraft quieter jet design should have to develop. Planting trees around houses can also act as effective barriers for noise pollution. To control interior noise in Industries, different types of absorptive material can be used. To reduce aircraft noise the aerodrome should be located away from the city. Though producing less noise is the best method of reduction of pollution. An individual can wear earplugs or earphones as a shield against noise pollution.

In 2000, the Indian Government notified the Noise Regulation Rules under the Environment (Protection) Act, 1986. In this law there is a prescribed limit of sound in different zones such as – in industry (75 db.), commercial (65 db.), residential zones (55 db.). The government also establishes silence zones within a radius of 100m of schools, courts, hospitals, etc. The permission for loudspeakers is only provided during day time. The rules and regulations are also fixed for different noise levels for firecrackers and industrial activities.

Q: 2) Short Note on Water Pollution:

Ans: Water is the basic requirement for survival. About 97% of the water on earth is present in seas and oceans but it is too salty for any use. Remaining 3% water is freshwater, out of which 75% is locked up in ice and glaciers and quite deep under the earth's surface which is known as underground water. Water pollution is the process when the harmful substances like chemicals, micro-organs, plastic, parasites, nitrates, fertilizers, etc. contaminate a stream, river, lake, ocean, aquifer or other water sources which degrades water quality and renders it toxic to humans or the environment. There are different types of water pollution like: surface water pollution, Nutrient pollution, oxygen depleting, Groundwater pollution, microbiological pollution, oil spillage, chemical pollution etc. Water pollutants come from point sources and nonpoint sources. Point sources include sewage treatment plants and factories which enter through pipes, sewers or ditches. With the help of law and regulations the government can regulate the discharge from point sources. When water pollutants enter the water body not from a single source but from various points over a large area, it is called water pollution from nonpoint sources. It includes surface run-offs, mining waste, municipal waste, construction sediments, acid rain and soil erosion. It is difficult to control.

Water Pollutants: Water Pollutants are can be broadly put under the following types:

- 1) **Industrial Pollutants:** Some industries discharge their untreated water in rivers which contain highly toxic heavy metals such as lead, mercury, arsenic along with hazardous wastes like acids, alkalis, Chlorides, etc. These pollutants damage the growth of crops and makes water unsafe for drinking purposes.
- 2) **Agriculture waste:** Fertilizers, pesticides, wastes from farms, poultry farms, salts, manure are the one of the water pollutants. When these pollutants are mixed with water it leads to consequent depletion of dissolved oxygen. Consumption of such water is bad for humans as it contains high portions of nitrates.
- 3) **Physical Pollutants:** Physical pollutants include radioactive waste, thermal sources, sediments (soil particles), and petroleum products. Etc. Due to leaching of minerals radium and potassium found in water. Water bodies are polluted by some waste material from uranium and thorium mines, nuclear power plants, research laboratories and hospitals. When such material enters human bodies, it causes tumours and cancer.
Petroleum products are widely used for fuels, lubricants, plastic manufacturing etc. Due to accidental spillage from ships, tankers, pipelines crude oil entered the water. This oil slick which floats on the water surface has an adverse effect on marine life.
- 4) **Domestic and sewage Pollutants:** The sewage contains garbage, soaps, detergents, waste food etc. This water carries certain other bacteria and viruses and reproduces in the cells of host organs.

Effect of Water Pollutants:

Sediments: It is a part of soil erosion. Excessive amounts of soil particles carried by flowing water in ocean, streams or lakes. It reduces photosynthesis, clogs reservation, destroys the grounds of fish and disrupts aquatic life.

Oxygen-demanding organic wastes: Plant debris and sewage, waste from paper mills and food processing facilities are examples of organic waste. The bacteria which decompose these wastes deplete oxygen and cause death of fish and other aquatic organisms.

Organic compounds: Synthetic chemicals are harmful for human beings. It contains carbon. Basically, it releases from industrial effluents, surface runoff and cleaning agents. It causes many health problems in humans and also harms other wildlife.

Inorganic nutrients: Inorganic nutrients can cause eutrophication (high level of nitrates and phosphate). Increase in population, industrialization and intensive growth of agriculture is the main cause of such an effect. It affects infants in many cases.

Inorganic chemicals: Acids, salt, heavy metals such as lead and mercury from industrial effluents, surface runoff, and household cleaning agents are the main

sources of inorganic chemicals. It dilutes with water and degrades drinking water and it causes skin cancer, damages the nervous system, corrodes structure.

Radioactive substances: Waste from nuclear power plants, nuclear weapons production facilities etc diluted with water and causes cancers, birth defects etc.

Infectious microorganism: Parasitic worms, viruses, and bacteria from infected organisms as well as human and animal wastes. These microorganisms cause water borne diseases that kill thousands of adults and children primarily in developing countries.

How do we measure Water quality? (Drinking water Quality standard):

There are three ways to measure water quality:

- 1) **Biological Oxygen Demand (BOD):** With the help of this parameter the degree of water pollution can be measured from oxygen-demanding wastes and plant nutrients. In breaking down organic waste in water bodies, the quality of oxygen used by microorganisms at 27 degrees Celsius and put it in darkness for 3 days, this process is called BOD. This BOD is measured in parts per million (ppm). A BOD level of 1-2 is considered very good. It shows that there is not much organic waste present in the water body. The moderate level of BOD is 3-5 ppm. Any water with BOD level 6-9 ppm is considered polluted which shows presence of bacteria in water waste. At BOD levels of 10 ppm or more is considered much more polluted. In simple words if there is a greater amount of organic waste in the water body it requires more oxygen to break water waste.
- 2) **Chemical Analysis:** The presence of chemicals like pesticides can be measured by different experiments and analysis. It helps to judge water purity.

Legislative Measures to prevent Water Pollution:

To prevent water pollution in India “Prevention and Control of Water Pollution Act” in 1974 was established. The standards are prescribed in water pollution under Environment (Protection) Act 1986.

- Specific standards are prescribed for industry
- Standards are described the amount of waste water to be discharges for the industries
- Standards to define production capacity

Along with that, the state government has also some power to take action against defaulting industries or units.

UNIT: 3

Q: 1) Write short note on Radioactive Pollution:

It is also known as radiation pollution. It is a physical type of environmental pollution. It causes an extreme effect on human being as well as on animals and plants. Radiation means any energy produced by fast moving particles or waves. These radiations can be classified into two types: non-ionizing radiations and Ionizing radiations. Non- ionizing radiations are longer wavelength from ultraviolet rays to radio waves. Ionizing radiations have high energy. They have short wavelengths such as x-rays, gamma rays.

Radioactive pollution refers to the emission of high energy particles or radioactive substances into air, water or land due to man-made activities. It is just like other pollution where unwanted particles and substances are released into the environment; in this pollution unwanted radioactive particles are to be released into the environment. There are three types of nuclear radiations: alpha particles, beta particles and gamma rays. Alpha particles are least penetrating as it can travel only up to 5 to 8 cm in air. Gamma is the most penetrating amongst all three. Beta particles are nearly 100 times more penetrating in nature. The toxicity is lowest in alpha and highest in gamma.

Sources of Radioactive Pollution:

There are mainly two sources of Radioactive Pollution:

- 1) Natural Sources
- 2) Anthropogenic sources

1) Natural Sources:

- Cosmic rays are one of the natural sources of radioactive pollution. The cosmic rays are associated with stars from our galaxy. Due to the virtue of nuclear reaction such rays enter our spaces. These rays constantly enter the earth; atmosphere from outer space.
- Elements such as radium 224, uranium 235, uranium 238, thorium 232, radon 222 and carbon 14 occur in the lithosphere. Such minerals are contaminated with water; it makes natural radioactive pollution.
- The background radiation is also one of the most natural resources of radioactive pollution.

2) Anthropogenic Sources:

- **Nuclear test:** This is the major cause of radioactive pollution. During such tests numbers of long-lived radionuclides are released in the air. These particles dilute with water during rain and get mixed with soil and water, from where they can easily enter the human body through the food chain. It is too hazardous in nature.

- **Nuclear Reactor:** Nuclear reactors are one of the sources of energy production. Leakage in such places may increase the risk of radiation. Though man uses best design, proper handling and techniques, some radioactive particles are routinely released into air and water.
e.g., accidents at 'Chernobyl nuclear power plant' in USSR in 1986 and at the 'Three Mile Island Power Plant' in USA in 1979.
- **Diagnostic medical application:** For some diagnostic and therapeutic applications some radioactive particles are used. X-rays and CT scans are generally used in radiology. For cancer treatment gamma rays are used. Such uses are manmade and it requires careful planning and operations.
- **Nuclear explosions:** These are the serious man-made source of radiation. Nuclear weapon, atom bombs are the part of it. The worst impact of it on Nagasaki and Hiroshima are still not forgotten.
- **Nuclear Waste:** Uranium, Plutonium, Radon etc. are difficult to split. Uranium has a half-life of more than 700 years. It can't be destroyed properly. They are always stored somewhere on this earth. When it emits in the air it causes air pollution.

Effects:

- 1) **Genetic Mutation:** Radioactive pollution causes damage to DNA strands, which can break some genetic forms. Its effect is visible. The degree of genetic mutation may vary according to its consumption. When a human or animal is exposed to too much radiation from the atmosphere their body absorbs the radiation. Due to mutation some severe disease like cancer, blindness in children, genetic defects in physique etc. can be caused.
- 2) **Disease:** The most dominant and worst disease linked with radioactive pollution is Cancer. It has developed over the years and makes a dangerous impact on global health. Other than this disease leukaemia, anaemia, haemorrhage, premature death, cardiovascular disease can be caused due to radioactive pollution.
- 3) **Infertility of Soil:** When any nuclear exposure occurs, it pertains in soil as well. When radioactive contaminated with soil nutrients it becomes highly toxic and infertile. Such land is unfit for human and animal consumption.
- 4) **Burns:** Radioactive is not easy to feel but easy to realise that the human body is affected by it. The immediate presence of burn, red lesions and sores is evidence of infection. It can lead to skin cancer.
- 5) **Effect on Plant life:** Due to increase in UV rays, plants also got affected by radioactive pollution. It reduces seed germination. Though different plants affect differently. Due to radiation ches the chromosomes, the reproduction process hindered. It changes its shape, type and sizes.

Preventive and control measures:

- Radioactive particles need to be stored in specialized container, to avoid any leakage
- A clear warning about the presence of radioactive material should have to be given..
- Radioactive particles should be disposed of properly. It cannot be easily buried in the soil or thrown into the garbage. Some radioactive waste can be 'recycled' and used to generate more nuclear energy.
- The best practice of prevention is to search for alternative sources of nuclear energy such as renewable energy instead of nuclear plants.
- To prevent radiation in nuclear plants or reactors, a closed cycle coolant system can be implemented. The production and usage of radioisotopes should have to be reduced and only for essential requirements it can be procured.
- The number of nuclear plants should be minimized.
- Industrial radioactive waste should be disposed of very carefully in special built tanks.
- To provide high ventilation and chimneys in working places where radioactive emission is possible.

Regulation Regarding Safety Measures:

An autonomous Body of the Atomic Energy Commission "Atomic Energy Regulatory Board" carries out all regulatory and safety functions. For such purposes the Atomic Energy Act, 1962 has been established. It provides different rules and regulations, site selection, design, construction and operations for nuclear plant installation.

UNIT: 4

Q: 1) Explain Assessment and control of Pollution and use of Biotechnology in Pollution Control.

Environmental pollution has captured everyone's attention. For such a reason assessment is the most important aspect. In India, 1994 Environmental Impact Assessment (EIA) was made mandatory. It requires an environmental management plan, project report accordingly. They have made 30 different categories of projects for assessment and evaluation such as nuclear power, river valley, ports, harbours, tourism projects especially between 200 and 500 m of high-water line, thermal power plant, mining projects, highway projects etc.

The ministry of Impact Assessment Agency evaluates EIA reports which should be completed within 90 days from submission of documents. The permission for any project is permissible for five years from commencement of the construction or operation of the project.

The air quality assessment technique is the most important technique to know the position of air pollutants in the air. It can be expressed in AQI (Air quality Index).

Air Quality Index level	Numerical Value
Good	0-50
Moderate	51-100
Unhealthy for sensitive group	101-150
Unhealthy	151-200
Very Unhealthy	201-300
Hazardous	>300

With the help of this the pollution level can be obtained in different cities. To assess Water quality, a water quality index (WQI) is used. This is as follows:

Classification	pH	BODmg/l
Drinking water	6.5-8.5	2 or less
Recreation activity	6.5-8.5	3 or less
Conventional treatment	6.5-8.5	6 or less
Fisheries	6.5-8.5	6 or less
Industries	6.5-8.5	10 or less
Irrigation	6.5-8.5	10 or less

If in water pH and BOD level increases then it is a sign of pollutants are diluted in water.

Soil pollution is degradation process. Soil quality assessment is valuable for agricultural production The pollution index (PI), integrated pollution index (IPI), bioaccumulation factor and translocation factor (TF) were determined to ensure soil contamination and phytoremediation availability. Soil respiration helps to measure the amount of CO₂ released from the soil. With the help of Bulk density, the weight of the soil per volume can be measured. pH in water assessment indicates whether soil is acidic or not.

For radioactive pollution assessment different standards are maintained. Radioactivity is measured in Becquerel (SI unit) or in Curie. The World Health Organization set guidelines for drinking water quality and a permissible limit of reference dose level of 0.1 microsieverts per year.

Legislations or provisions to prevent and control Pollution:

- 1) **Air Prevention and Control of Pollution Act, 1981:** The main object of this act is to prevent, control and abatement of air pollution. This provision is implemented by CPCB- Central Pollution Control Board along with different state boards. This act includes different requisites such as; setting air quality standards, collection of data on air pollution, organising training control areas

and standards for vehicular emissions. It has also mentioned some penalties for violation of its provisions.

- 2) **Water- related Environmental Act:** For water pollution prevention different types of laws are made such as; The Easement Act of 1882, The Indian Fisheries Act, 1897, the Merchant Shipping Act, 1970, and Water (Prevention and Control of Pollution) Act, 1974 (the “Water Act”). The main objective of such an act is to protect groundwater, coastal areas and to prohibit water discharge of pollutants in water resources. The water tax is also managed under such an act. The water act is also governed by CPCB and state authorities.
- 3) **Forest Conservation Act, 1980:** This act provides protection to forests. It specifies different requirements that should be met before declaring an area a protected forest, wildlife sanctuary, or a national park. Under this act the state government can regulate or prohibit the clearing land for cultivation etc.
- 4) The hazardous Waste Management and Handling Rules, 1989 which helps to control waste management
- 5) The Chemical Rules of 1989 focuses on different work like inspecting industry activities which are related with hazardous chemicals and isolated storage facilities.
- 6) The coastal Regulation Zone Notification of 1991 regulates different activities in coastal areas.

Biotechnology and Pollution Control: Biotechnology is a unique approach towards pollution control. Biotechnology provides an efficient path towards monitoring, addressing, and assessing environmental issues. In the following areas biotechnology has proved very effective to tackle environmental issues.

➤ **Landfill Technologies:**

Due to urbanization and growth of population the solid waste has increased drastically. It includes plastic, glass, non-bio-degradable material, food waste etc. Landfill is an integrated waste management system. In such a system the waste deposit is compressed and covered by a layer of soil every day. With the help of biotechnology, the study of bacteria and hazardous substances can be discovered. With the help of biotechnology, the rapid degradation of waste can be done.

➤ **Composting:** Composting refers to the biological accelerated natural process of biodegradation and mineralization by self- heating. It is also helpful in solid waste management. It is a kind of fermentation process. It enables the reuse of organic material derived from domestic, agriculture and food industry wastes.

➤ **Bioremediation:** It is known as bio-treatment or bio-restoration. Due to pollutants the ecological balance of the environment got disturbed. With the help of bio-technology we can help the environment from hazardous contaminants. In this process it speeds up the breaking down of biological

substances with the help of naturally existing microorganisms. This method can help to clean up the environment in two ways:

- 1) **Addition of Nutrients:** The addition of Microbial acclimates in toxic waste. Over a period of time, the microbes mixed with compound waste helped to degrade pollutants.
- 2) **Engineer Microorganism:** an organism which can be seen only through a microscope is called microorganism. This method helps to degrade pollutants. The microbe helps to clean up toxic sites. For e.g., to remove pentachlorophenol from contaminated soil, American organisations used the 'Flavobacterium' species. In short, with the help of different microbes the toxicity of waste can be reduced.

Bioremediation comprises biological agents, which decreases hazardous compounds.

Bio mining (Bioleaching): Mining is also the worst problem of environmental pollution. Bio mining is the process to extract metals of economic interest from rock ores or mine waste with the help of microbes or microorganisms. In simple word Bio-mining means conversion of impenetrable valuable metals into penetrable form by means of microorganism. Bio mining helps to clean up sites that have been polluted with metals.

Advantages of Bio-mining:

- It helps to stabilize sulphate toxins from mine without any harmful event to the environment.
- It helps to emit sulphur dioxide from the environment
- It is cost-efficient technique

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Multiple Choice Questions (MCQs):

- Pollution is mainly caused by ____
Human activities
Trees
Sea waves
Heavy rains
- According to a 2015 survey, pollution killed ____ million people.
5
9
11
15
- Some pollution can be caused by natural events like forest fires and volcanoes.
True
False
Neutral
None of the above
- From the following ____ is not a source of air pollution.
Automobiles
Industries
Solid waste
Dust Particles
- Acid rain caused by oxides of ____
Phosphorus and Carbon
Sulphur and Nitrogen
Sulphur and Phosphorus
Nitrogen and Carbon
- ____ Agent is responsible for turning Taj Mahal yellow.
Sulphur dioxide
Chlorin
Carbon Monoxide
All of the above
- Which of the following gases are called Greenhouse gases?
Methane
Nitrogen
Carbon dioxide
Both a and c
- Which of the following is the second air pollutant?
Sulphur dioxide
Carbon dioxide
Ozone
All of the above
- What is Noise?

Desirable sound

Desirable and Unwanted sound

Undesirable and wanted sound

Undesirable and Unwanted sound

10. Sound is usually measured in ____

ohm

Pascal

Decibel

Joule

11. What is the db. of a threshold of pain?

99

105

120

146

12. In most freshwater lakes, the algal productivity is limited by the availability of which of the following inorganic ions?

Carbon

Phosphorus

Nitrogen

All of the above

13. Which of the following is not a waterborne disease?

Measles

Typhoid

Cholera

Hepatitis

14. Organic agriculture advocates avoiding the use of _____

Organic manure

Store water

Modern technologies in harvesting

Chemical fertilizers

15. How does soil pollution affect plants?

Hurts its feeling

Increase toxicity level in plants

Can't be used

All of the above

16. Exposure to excessive noise pollution can cause;

Hearing impairment

Insomnia

Respiratory disease

A and B

17. Which is the most input of waste causing marine pollution?

Pesticides

Pipes directly discharge waste into the sea

Death of aquatic organisms

Climatic conditions

18. How much water on earth is covered by the ocean?

31%

50%

95%

97%

19. Which of the following problems occurs due to the use of nuclear energy?
Accidental leakage
Formation of compost
Generation of electricity
All of the above
20. Which of the following causes mutations at a very high rate?
Automobiles
Compost
Fertilizers
Radiation
21. Which of the following elements is most hazardous to humans?
Phosphorous
Sulphur
Carbon
Uranium
22. Man Made sources of radiation pollution are:
Mining
Explosion of nuclear weapons
Nuclear fuels and preparation of radioactive isotopes
All of these
23. The effects of radioactive pollutants depend upon
Rate of diffusion
Energy releasing capacity
Rate of deposition of the contaminant
All of these
24. Majority of the waste produced by commercial industries have better result when treated by _____
Biological method
Chemical Method
Physical Method
All of the above
25. Environmental biotechnology involves _____
The use of microbes to clean up the environment
Bioremediation
Study of benefits and hazards
All of the above
26. To prevent radioactive pollution in India _____ act has been made.
Atomic Energy Act, 1962
Atomic Energy Act, 1963
Atomic Energy Act, 1964
Atomic Energy Act, 1968
27. When did the Government of India pass the Environment Protection Act?
1990
1986

1896

2000

28. In ____ year the Indian Government has notified the Noise Regulation Rules under the Environment (Protection) Act.

1996

1998

2000

2002

29. In Water quality standard BOD stands for ____

Biological Oxygen Demand

Biological Oxygen Degradation

Biological Oxidise Demand

None of the above

30. Main source of noise pollution is:

Transportation

Musical Instruments

Heavy Machinery

A and C

