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Department of Employment and Training

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Topic : Environmental Pollution and Management

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ENVIRONMENTAL POLLUTION AND MANAGEMENT

ENVIRONMENTAL POLLUTION AND MANAGEMENT:

ENVIRONMENTAL POLLUTION:

Environmental pollution occurs when pollutants contaminate the natural surroundings. Pollution disturbs the balance of our eco system affecting our normal life styles and gives rise to human illnesses and global warming. The word 'pollute' means to degrade or to make dirty. Pollution is thus, an unfavorable modification of the natural world, caused entirely or partly due to direct or indirect actions of human beings also Pollution is an unwanted change in the physical, chemical and biological characteristics of our land, air and water. Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.

In terms of eco-system, pollutants can be classified into two basic groups – Non-degradable and degradable. Based on the time taken to breakdown into their ingredients, degradable pollutants are classified as rapidly degradable (non-persistent) and slowly degradable (persistent).

a) Rapidly degradable or non-persistent pollutants: These can be broken down by natural processes. Domestic sewage and vegetable waste are examples of such pollutants.

b) Slowly degradable or persistent pollutants: These are pollutants that remain in the environment for many years in an unchanged condition and take decades or longer to degrade, as in the case of DDT.

c) Non-degradable pollutants: These cannot be degraded by natural processes. Once they are released into the environment, they are difficult to be eliminated and continue to accumulate (biomagnification). Toxic elements like lead, mercury, cadmium, chromium and nickel are such common pollutants.

Types of pollution

1. Air pollution
2. Water pollution
3. Soil pollution or land pollution
4. Thermal pollution
5. Noise pollution

1.AIR POLLUTION:

Air pollution is the presence of any solid, liquid, or gaseous substance in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

Types of Air pollution

Indoor Air Pollution: It refers to toxic contaminants that we encounter in our daily lives in our homes, schools and workplaces. For example, cooking and heating with solid fuels on open fires or traditional stoves results in high levels of indoor air pollution.

Outdoor Air Pollution: It refers to ambient air. The common sources of outdoor air pollution are caused by combustion processes from motor vehicles, solid fuel burning and industry.

Types of pollutants:

The natural pollutants are volcanic eruptions, wind erosion, pollen disposal, evaporation of organic compounds and radioactive elements etc., Natural air pollution does not occur in abundance and also creates a little impact on the environment.

Manmade pollutants like vehicular emission, industrial wastes, smoke from thermal power plants and refineries badly affect the environment. The main pathological effects caused by air pollutants, particularly oxides of Sulphur, nitrogen and carbon-di-oxide, include respiratory disorders, jaundice, irritation of eyes and throat, headache, cancer and even death.

Causes of Air Pollution

Vehicle exhaust smoke: Vehicles smoke happens to release high amounts of Carbon monoxide. Millions of vehicles are operated every day in cities, each one leaving behind its own carbon footprint on the environment. The vehicles are cars, buses, airplanes, trucks, trains.

Fossil Fuel based power plants: Fossil fuels also present a wider scale problem when they are burned for energy in power plants. Chemicals like sulfur dioxide are released during the burning process, which travel straight into the atmosphere. These types of pollutants react with water molecules to yield something known as acid rain. For example: power plants, incinerator, oil refineries.

Exhaust from Industrial Plants and Factories: Heavy machineries located inside big factories and industrial plants also emit pollutants into the air.

Construction and Agricultural activities: Potential impacts arising from the construction debris would include dust particles and gaseous emissions from the construction sites. Likewise, using of ammonia for agriculture is a frequent by product that happens to be one of the most dangerous gases affecting air. The agricultural sources are wood, stubble burning, fire places.

Natural Causes: Earth is one of the biggest polluters itself, through volcanoes, forest fires, and dust storms. They are nature-borne events that dump massive amounts of air pollution into the atmosphere. The sources are windblown dust, wildfires, volcanoes.

Household activities: Household activities like cooking, heating and lighting, use of various forms of mosquito repellents, pesticides and chemicals for cleaning at home and use of artificial fragrances are some of the sources that contribute to air pollution.

Effects of Air Pollution

Respiratory and heart problems: It creates several respiratory and heart ailments along with cancer. Children are highly vulnerable and exposed to air pollutants and commonly suffer from pneumonia and asthma.

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Global warming: Increasing temperature in the atmosphere leads to global warming and thereby to increase sea level rise and melting of polar icebergs, displacement and loss of habitat. Green House gases such as carbon dioxide, methane, water vapour and Chloro-Fluro Carbons (CFC), carbon monoxide, photo chemical oxidants and hydrocarbons, which are responsible for the heat retention ability of the atmosphere.

Acid rain: Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. Acid rain causes great damage to human beings, animals and crops.

Eutrophication: Eutrophication is a condition where high amount of nitrogen present in some pollutants which adversely affects fish, plants and animal species.

Effect on Wildlife: Toxic chemical present in the air can force wildlife species to move to new place and change their habitat.

Depletion of Ozone layer: Ozone exists in earth's atmosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to presence of chlorofluorocarbons and hydro chlorofluorocarbons in the atmosphere.

Human Health: Outdoor air pollution is a major cause of death and disease globally. The health effects range from increased hospital admissions and emergency room visits, to increased risk of premature death. An estimated 4.2 billion premature deaths globally are linked to ambient air pollution.

Gas leaks can be lethal or affect the quality of air in the affected area.

CO in the atmosphere interferes with O₂ transport since hemoglobin has greater affinity for carbon monoxide. At low concentration it causes headache and blurred vision. In higher concentration, it can lead to coma and death.

Smog:

Smog is a type of air pollution caused by tiny particles in the air. Smog generally refers to photochemical smog, which is created when sunlight reacts with nitrogen oxides and volatile organic compounds found in fossil fuel emissions from automobiles, factories,

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and power plants. These reactions create ground-level ozone and particulate matter, reducing visibility. Smog can make breathing more difficult, especially for people with asthma. Smog also affects plants and animals. It damages crops as well as causes health problems in pets, farm animals and human beings. Smog has also been known to cause corrosive damage to buildings and vehicles.

Peroxyacetyl nitrate (PAN) is a secondary pollutant present in photochemical smog. It is thermally unstable and decomposes into peroxy-Ethanol radicals and nitrogen dioxide gas causing eye irritation.

Remedial measures to control Air Pollution

- 1) Establishment of industries away from the towns and cities
- 2) Increasing the length of the Chimneys in industries
- 3) Growing more plants and trees
- 4) Use of non-conventional fuels like Biogas, CNG and LPG.
- 5) Use of Mass Transit System (Public Transport)
- 6) Cycle or walk short distances instead of using a motor vehicle.
- 7) Do not burn solid waste.
- 8) Avoid fireworks.
- 9) Trees are the best remedy for urban particulate and gaseous pollution
- 10) Forests act as carbon sinks and lungs of the planet

Legal Protection

1. The Air (Prevention and Control of Pollution) Act was enacted in 1981 and amended in 1987 for the prevention, control and abatement of Air pollution in India.
2. Traffic Emissions Standards: The Government has decided to enforce Bharat Stage VI norms from 2020.
3. The Green Bench and the National Green Tribunal (NGT) give judicial safeguard to environmental protection. Taj trapezium zone under environmental protection act 1986.

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Steps taken by the Central and the State governments in India:

1. Road traffic rationing, encourage public transport, carpooling.
2. Increase green cover alongside roads (planting avenue trees).
3. Promoting Swachh Bharat Abhiyan
4. Enactment and Enforcement of stricter environmental laws.
5. Maintenance of air standards by proper enforcement and monitoring Reducing carbon emissions.
6. Encourage use of renewable energy.
7. Limiting the sale of firecrackers and developing eco-friendly crackers.
8. Make Environmental Impact Assessment mandatory
9. Air Quality Index (AQI) is a number used by government agencies to communicate to the public how polluted the air is at a given time.

2.WATER POLLUTION

The introduction (directly or indirectly) of substances or energy into the marine environment (including estuaries) results in deleterious effects to living resources, hazards to human health, hindrance to marine activities.

Sources of Water Pollution

Even though water bodies or sources can be polluted by natural causes, water pollution is usually caused by human activities. There are three main types of sources: point sources, non-point sources, leaks and spills.

Point sources: Discharge of pollutants at specific locations through pipelines or sewers into the water body. Factory effluents, sewage, underground mines, oil wells, oil tankers and agriculture are common point sources.

Non-point sources: Sources that cannot be traced to a single site of discharge like acid rain, dumping of the plastics in water bodies, agriculture chemical run off are common examples.

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Leaks and Spills: This occurs mostly due to ship collision, off shore oil rigs, oil leakages and discharges into sea Sources of water pollution can also be classified in three ways. They are municipal wastes, industrial wastes, and agricultural wastes.

1. Municipal waste water is from homes and commercial establishments.
2. Industrial discharge (effluents) may contain varieties of compounds such as heavy metals (cadmium, chromium, lead), and organic / inorganic chemicals
3. Containing waste water, sometimes in toxic concentrations. These discharges can affect temperatures of the water bodies as well as dissolved oxygen level.
4. Agricultural wastes include fertiliser and pesticide runoff from agricultural fields, food processing waste, tree and saw dust from logging operations and bacteria from sewage or livestock operations. Water pollutants reach water bodies like rivers, streams and the marine system by precipitation, run-off and the groundwater by seepage or percolation.

Types of Water Pollution

1. **Surface water pollution:** Surface water includes natural water found on the earth's surface, like rivers, lakes, lagoons and oceans. Hazardous substances coming into contact with this surface water, dissolving or mixing physically with the water can be called surface water pollution.
2. **Groundwater pollution:** Groundwater contamination occurs when man- made products such as gasoline, oil and chemicals get into the ground water. In addition, untreated waste from septic tanks, toxic chemicals from underground storage tanks and leaky landfills contaminate groundwater.
3. **Microbiological pollution:** In many communities around the world, people drink untreated water (straight from a pond, river or stream). Sometimes there is natural pollution caused by micro-organism like viruses and bacteria. This natural pollution causes both aquatic and human illness.
4. **Oxygen depletion pollution:** When oxygen levels in the water are depleted, relatively harmless aerobic micro-organisms die and anaerobic micro-organisms begin to thrive. Some anaerobic micro-organisms are harmful to people, animals

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and the environment as they produce harmful toxins such as ammonia and sulfides.

Major water pollutants:

- a) The disease – Causing agents; bacteria, viruses, protozoa and parasitic worms that enter sewage – systems and untreated waste.
- b) Oxygen demanding bacteria: Wastes that can be decomposed by oxygen requiring bacteria.
- c) Water soluble inorganic pollutants: Acids, Salt and toxic metals.
- d) Organic compounds: Oil, plastics and pesticides in the water.

Causes of Water Pollution

Water pollution is caused due to several reasons. Here are the few major causes of water pollution:

1. **Discharge of sewage and waste water:** Sewage, garbage and liquid waste of households, agricultural runoff and effluents from factories are discharged into lakes and rivers. These wastes contain harmful chemicals and toxins which make the water poisonous for aquatic animals and plants.
2. **Dumping of solid wastes:** The dumping of solid wastes and litters in water bodies cause huge problems.
3. **Discharge of industrial wastes:** Industrial waste contains pollutants like asbestos, lead, mercury, grease oil and petrochemicals, which are extremely harmful to both people and environment.
4. **Oil Spill:** Sea water gets polluted due to oil spilled from ships and tankers while travelling. The spilled oil does not dissolve in water and forms a thick sludge polluting the water.
5. **Acid rain:** Acid rain is pollution of water caused by air pollution. When the acidic particles caused by air pollution in the atmosphere mix with water vapor, it results in acid rain.

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6. **Global warming:** Due to global warming, there is an increase in water temperature as a result aquatic plants and animals are affected.
 7. **Eutrophication:** Eutrophication is an increased level of nutrients in water bodies. This results in bloom of algae in water. It also depletes the oxygen in water which negatively affects fish and Other aquatic animal population.

Effects of Water Pollution

Water pollution adversely affects the health and life of man, animals and plants alike. Polluted water is also harmful for agriculture as it adversely affects the crops and the soil fertility. Pollution of sea water damages the oceanic life. The effects can be catastrophic, depending on the kind of chemicals, concentrations of the pollutants. The effects of water pollution are varied and depend on what chemicals are dumped and in which locations. Many water bodies near urban areas are highly polluted. This is the result of both garbage dumped by individuals and dangerous chemicals legally or illegally dumped by manufacturing industries, health centers and markets.

1. **Death of aquatic animals:** The main problem caused by water pollution is that it kills organisms that depend on these water bodies. Dead fish, crabs, birds and sea gulls, dolphins, and many other animals often wind up on beaches, killed by pollutants in their habitat.
2. **Disruption of food-chains:** Pollution disrupts the natural food chain as well. Pollutants such as lead and cadmium are eaten by tiny animals. Later, these animals are consumed by fish and the food chain continues disrupted at all higher levels.
3. **Diseases:** The discharge of untreated and under-treated effluent contributes to severe ecological degradation. The indiscriminate human activities such as open defecation, solid waste dumping, discharge of drainage water is responsible for the pathogenic bacteria water-borne diseases like Hepatitis-A, Typhoid, Malaria, Dysentery, Jaundice, Dengue fever, Viral fever and Worm infections.
4. **Destruction of Ecosystems:** Ecosystems can be severely destroyed by water pollution. Many areas are now being affected by careless human pollution, and this pollution is coming back to hurt humans in many ways.

Remedial measures to control Water Pollution

Legal measure:

- 1) Right to clean water is a fundamental right under the Indian Constitution.
- 2) Water (Prevention and Control of Pollution) Act, 1974, sections 17 to 40 prohibit the pollution of a stream or well by disposal of polluting matter.
- 3) The Central/State Pollution Control Boards have the power to advise the central/state government on various matters concerned with the prevention and control of pollution of water.
- 4) The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency of the Central Government for the planning, promotion, co-ordination and for overseeing the implementation of India's environmental and forestry policies and programmes.

Prevention

- 1) Regulate or control of pollutant(s) discharge at the point of generation.
- 2) Wastewater can be pre-treated by scientific methods before discharge to municipal treatment sources.
- 3) Setting up of Sewage Treatment Plants (STP) and Effluent Treatment Plants (ETP).
- 4) Regulate or restrict the use of synthetic fertilisers and pesticides.
- 5) Public awareness and people's involvement is essential.

Others:

- 1) Comprehensive water management plan.
- 2) Construction of proper storm drains and settling ponds.
- 3) Maintenance of drain line.
- 4) Effluent and sewage treatment plant.
- 5) Regular monitoring of water and waste water.
- 6) Stringent actions towards illegal dumping of waste into the water bodies.

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Case study

Namami Gange (National Mission for Clean Ganga) Programme is an Integrated Conservation Mission approved as the 'Flagship Programme' of the Union Government in June 2014 with a budget outlay of 20,000 crores to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga.

3.SOIL POLLUTION:

Soil pollution is another form of land pollution, where the upper layer of the soil is damaged. This is caused by the overuse of chemical fertilizers, and pesticides. This leads to loss of fertile land. Pesticides kill not only pests and also human beings.

1.Types of Soil Pollution

1. Agricultural soil pollution
2. pollution due to industrial effluents
3. pollution due to urban activities

2.Causes:

Improper agricultural practices like overuse of land in-terms of grazing, Agriculture etc.

1. Nuclear wastes
2. biological wastes
3. Disposal of coal ash
4. Electronic waste
5. Industrial activity
6. Agricultural chemicals like pesticides, weedicides, insecticides
7. Improper disposal of waste.
8. Pollution due to urbanization
9. Deforestation and soil erosion.

3.Sources:

- 1) **Industrial waste:** It includes chemicals such as mercury, lead, copper, cadmium, cyanides fly ash, metallic residues, zinc, cyanides, chromates, acids,

alkalis, organic substances, nuclear wastes. A large number of industrial chemicals, dyes, acids, etc. find their way into the soil.

- 2) Pesticides and fertilizers:** Pesticides are chemicals that includes insecticides, fungicides, algicides, rodenticides, weedicides sprayed in order to improve productivity of agriculture, forestry, and horticulture. Chloro hydrocarbons (CHCs) like DDT, endo-sulfan, heptachlor accumulate in soil and cause biomagnification. Some of these pesticides like DDT and endosulfan are banned by most of the countries. Excessive use of chemical fertilizer's reduces the population of soil-borne organisms and the crumb structure of the soil, productivity of the soil and increases salt content of the soil.
- 3) Discarded material:** It includes concrete, asphalt, rungs, leather, food, paper etc.
- 4) Radioactive material:** Radioactive elements from mining, nuclear power plants, find their way in to water and then soil.
- 5) Plastic bags:** They accumulate in soil and prevents germination of seeds. They stay in the soil for centuries without decomposing (non-biodegradable). Burning of plastic in garbage dumps release highly toxic and poisonous gases like carbon monoxide, carbon dioxide, phosgene, dioxins and other poisonous chlorinated compounds. Toxic solid residue left after burning remains in the soil. The harmful gases enter soils through chemical cycles.
- 6) Others:** Many air pollutants like acid rain and water pollutants ultimately become part of soil and soil also receives some toxic chemicals during weathering of certain rocks.

4. Effects:

1. Reduction in the fertility of soil due to increase in alkalinity, salinity or ph.
2. Soil erosion.
3. Emission of toxic gases.
4. Poisoning of the Ecosystem.
5. Contamination of underground and surface drinking water.
6. Reduced nitrogen fixation due to the reduced number of nitrogen fixers.

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7. Increased erosion due to loss of forests and other vegetation.

5.Control measures:

1. Reducing chemical fertilizer and pesticide use.
2. Use of bio-pesticides, bio fertilizers
3. Organic farming
4. Afforestation and Deforestation
5. Solid waste treatment
6. Reduction of waste from construction areas.

4. THERMAL POLLUTION

Thermal pollution is defined as sudden increase or decrease in temperature of a natural body of water which may be ocean, lake, river or pond by human influence. This normally occurs when a plant or facility takes in water from a natural resource and puts it back with an altered temperature. Usually, these facilities use it as a cooling method for their machinery or to help better produce their products.

The sources of Thermal Pollution

1. Nuclear Power Plant
2. Coal-fired power Plant
3. Industrial Effluents
4. Domestic Sewage
5. Hydro-electric power
6. Thermal Power Plant

Ecological Impacts of Thermal Pollution of Water

Other than man made sources of aquatic thermal pollution, changes in vegetation cover along the banks of the water body or increase in turbidity has been reported to cause increasing in temperature.

There are several effects of thermal pollution:

1. Sudden and periodic increase in temperature producing a thermal effect.
2. Changed dissolved oxygen.

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- 3. Distribution of organisms among major and minor communities.
 - 4. Death of stenothermic animals.
 - 5. Changes to reproductive powers and increased susceptibility to disease.
 - 6. Production of heat shock proteins for thermo tolerance.
 - 7. Changes in migration time and pattern may be affected.
 - 8. Bio indicators are the first to show the effects.
 - 9. Decrease in productivity of the water body.
 - 10. Economic and environmental damage.

The Harmful Effects of the Thermal Pollution

1. Reduction in dissolved Oxygen

The pollutant from various industrial plants are heated decreases the concentration of oxygen with an increase in the temperature of water.

2. Change in water properties

The decrease in density, viscosity and solubility of gases in water increases the setting speed of suspended particles which seriously affect the food supplies of aquatic organism.

3. Increase in toxicity

The concentrated pollutant causes the rise in the temperature of water which increases the toxicity of the poison present in water. The toxicity in water will increase the death rate in marine life.

4. Disruption of Biological activities

Temperature changes disrupt the entire marine ecosystem because changes in temperature causes change in physiology, metabolism and biological process like respiration rate, digestion, excretion and development of an aquatic organism.

5. Damage of biotic organism

Aquatic organisms like juvenile fish, plankton, fish, eggs, larva, algae and protozoa which pass through screens and condenser cooling system are extremely sensitive to abrupt temperature changes. They are habitual of warmer water may suddenly face

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increase or decrease in temperature of water bodies and thus die because of sudden changes in the temperature of water.

Prevention of thermal pollution

The following measures can be taken to prevent or control high temperature caused by thermal pollution:

1. Heated water from the industries can be treated before discharging directly to the water bodies.
2. Heated water from the industries can be treated by the installation of cooling ponds and cooling towers.
3. Industrial treated water can be recycled for domestic use or industrial heating.
4. Through artificial lakes: In this lake Industries can discharge their used or heated water at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

Hence, we can say any kind of pollution may directly or indirectly affect humans because the loss of biodiversity causes changes that affect all the aspects of the environment.

5.NOISE POLLUTION

Noise pollution is unwanted or excessive sound that can have deleterious effects on human health and environmental quality. Noise pollution is commonly generated by many factories. It also comes from highway, railway and airplane traffic and from outdoor construction activities.

Types of Noise Pollution

1. **Atmospheric Noise:** Atmospheric noise or static is caused by lightning discharges in thunderstorms and other natural electrical disturbances occurring in the atmosphere.
2. **Industrial Noise:** Industrial noise refers to noise that is created in the factories. Sound becomes noise it becomes unwanted. Heavy industries like ship building, iron and steel have long been associated with Noise Induced Hearing Loss (NIHL).

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3. **Manmade Noise:** The main sources of man-made noise pollution are ships, aircraft, seismic exploration, marine construction, drilling and motor boats.

Causes of Noise Pollution

1. **Poor urban planning:** Improper urban planning will cause more nuisances among the city travelers.
2. **Sounds from motor vehicles:** Sounds from motor vehicles can cause temporary hearing loss.
3. **Crackers:** Enormous Crackers are used during some occasions. Such activities create a very louder noise to the level of harming the public. Sometimes, they may even cause deafness to children and aged.
4. **Factory machinery:** The industrial noise caused by continuous operation of mills, machines and pneumatic drills, is unbearable nuisance to the workers.

Effects of Noise Pollution

1. **Hearing Loss:** Chronic exposure to noise may cause noise-induced hearing loss. Older people are exposed to significant occupational noise and thereby reduced hearing sensitivity.
2. **Damage Physiological and Psychological health:** Unwanted noise can damage physiological and psychological health. For example, annoyance and aggression, hypertension, and high stress levels.
3. **Cardiovascular effects:** High noise levels can contribute to cardiovascular problems and exposure to blood pressure.
4. **Detrimental effect on animals and aquatic life:** Noise can have a detrimental effect on animals, increasing the risk of death.
5. **Effects on wildlife and aquatic animals:** It creates hormone imbalance, chronic stress, panic and escape behaviour and injury.

Remedial measures to control Noise Pollution

Legal Protection

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- 1) Article 48-A and Article 51-A of the Constitution of India, Noise Pollution (Regulation and Control) Rules 2000, and Tamil Nadu State Environment Policy 2017 are some of the legal relief from noise pollution.

- 2) According to Noise Pollution (Regulation and Control) Rules, 2000, the permissible limit of noise in areas categorized as commercial is 65 decibels (dB) during day and 55 dB during night.

Others:

- 1) Use of noise barriers
- 2) Newer roadway for surface transport
- 3) Traffic control
- 4) Regulating times for heavy vehicles
- 5) Installations of noise barriers in the work place
- 6) Regulation of Loudspeakers
- 7) Turn off your electronics when you do not use them.
- 8) Lower the volume when you watch TV or listen to music.
- 9) Remind drivers not to use the horn too much.
- 10) Avoid fireworks.

Questions:

1. Discuss the air pollution causes and effects also mention the measure taken by government.
2. Give the detailed account of noise pollution.