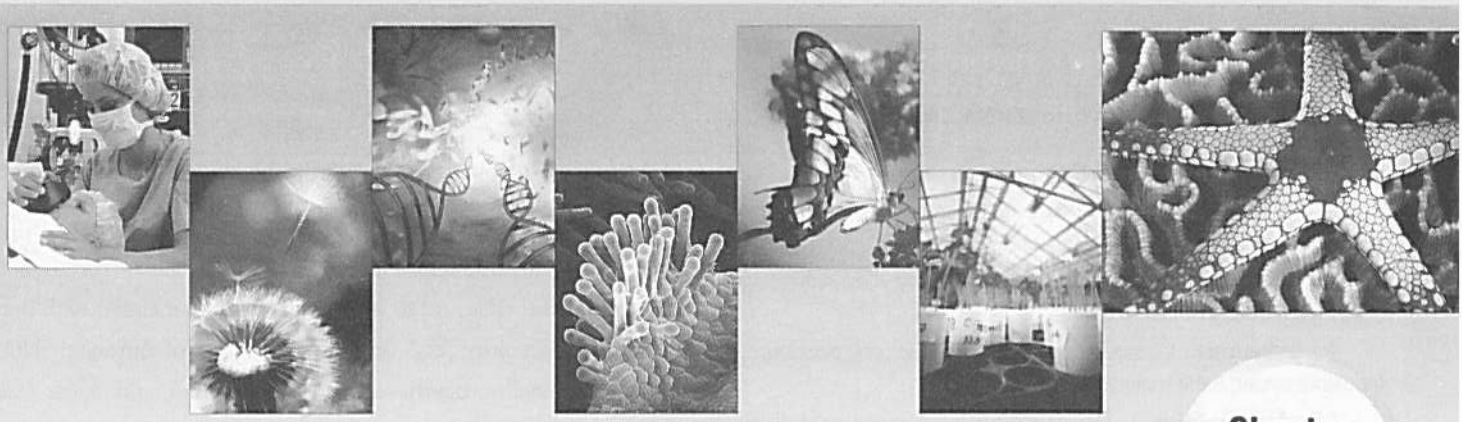


Chapter

10.5

Environmental Issues

Change in physical, chemical or biological characteristics of air, water and land that has the potentiality to harm human life, lives of other desirable species, industrial processes, living conditions, cultural assets and natural resources is called pollution.

Effects of pollution is first and most marked on natural flora of a place.

Pollutant : Pollutant is a substance (*e.g.*, fly ash), chemical (*e.g.*, ozone, nitrogen oxides) or factor (*e.g.*, radiation, noise, heat) which has the potentiality to harmfully affect human life, lives of other desirable species, industrial processes, cultural assets and natural resources. Pollutants are divisible into several categories. The important ones are as follows :

(1) **Primary pollutant :** Pollutant persisting in the environment in the form it is produced *e.g.*, carbon monoxide.

(2) **Secondary pollutant :** Pollutant formed from a primary one through change or reaction. Nitrogen oxides and hydrocarbons react photochemically to produce peroxyacyl nitrates and ozone. The secondary pollutants may be more toxic than the primary ones. The phenomenon is called synergism.

(3) **Qualitative pollutant :** The pollutant is a harmful substance, chemical or factor that does not occur in nature but is added by human beings, *e.g.*, insecticide, herbicide.

(4) **Quantitative pollutant :** It is a normal component of nature that becomes pollutant when its concentration becomes higher than the normal, *e.g.*, nitrogen oxides, carbon monoxide.

(5) **Degradable pollutant :** The pollutant degrades after some time either automatically (*e.g.*, heat) or through the agency of microorganisms (= biodegradable, *e.g.*, sewage, livestock wastes, market garbage). Biodegradable pollutants are easily disposed off or degraded through natural processes or waste treatment plants. They can be turned into a resource, *e.g.*, compost, manure.

(6) **Non-Degradable pollutant :** It is a pollutant which does not breakdown or get converted to harmless state by natural processes of dissipation, dispersal, oxidation or biological decomposition, *e.g.*, DDT, glass, plastic. It is also known as conservative or persistent pollutant.

Types of pollution

(1) **Natural pollution :** It is pollution caused by natural sources, *e.g.*, volcanic eruptions, release of methane by paddy fields and cattle, release of carbon monoxide by plants and animals, emission of natural gas, ozone, nitrogen oxides, soil erosion, dust storms, cosmic rays, ultra-violet rays, etc.

(2) **Anthropogenic or Man-made pollution :** It is pollution caused by human activities like noise, automobiles, industries, smoking, pesticides etc. Anthropogenic pollution is often quite small in quantity as compared to natural pollution. Example, 0.05% of atmospheric pollution is man-made while 99.95% is natural pollution.

- On the basis of source of pollution, it can be :

(1) **Air pollution :** Air or atmospheric pollution is the addition of materials or chemicals into atmosphere in such concentration that they begin to exert adverse effect on human beings, other desirable species, human assets and resources. Total amount of air pollutants is estimated to be 1×10^{12} tonnes, out of which pollutants added by human activities are only 5×10^{8} tonnes or 0.05%.

Types of air pollutants : It is of two types :

(a) **Primary air pollutants :** Air is polluted by poisonous gases and undesirable substances. They are released by burning fossil fuels. These substances are called primary air pollutants. The primary air pollutants are the following :

- Soot released from unburned fuel.
- Sulphur dioxide (SO_2).
- Benzopyrene (hydrocarbon) released from cigarette smoke.
- Ammonia (NH_3).
- Oxides of nitrogen.
- Carbon monoxide (CO).
- Lead (Pb).

(b) **Secondary air pollutants :** Secondary air pollutants are poisonous substance formed from primary air pollutants. In bright sunlight nitrogen, nitrogen oxides, hydrocarbons and O_2 interact to produce more powerful photochemical oxidants like ozone (O_3), peroxyacetyl nitrate (PAN), aldehydes, sulphuric acid, peroxides, etc. All these constitute photochemical smog, which retard photosynthesis in plants. PAN causes eye burning and checks hill reaction of photosynthesis.

(i) **Causes of air pollution**

(a) **Agriculture :** Hydrocarbons released by plants, pollen grains, insectisides etc. cause air pollution.

(b) **Dust :** Dust in the air is increased by dust storms wind, volcanoes, automobiles, etc.

(c) **Industries :** Combustion of fossil fuels like coal, petroleum, etc. Industrial smoke is the main source of pollution.

(d) **Automobiles :** The combustion of petrol and diesel in automobiles releases harmful gases into the air. They also produce dust.

(e) **Ionising radiations :** Ionizing radiations include alpha particles, beta particles and gamma rays. They are released into the air on testing atomic weapons.

(f) **Freons :** Use of freons and other chloro-fluoro-carbon compounds in refrigerants, coolants and as filling agents in aerosol also cause pollution.

(g) **Aerosols :** Chemical released in the atmosphere with force in the form of mist or vapours are called aerosols. Jet-aeroplanes release aerosols which contain CFC. Aerosols are small particles of all sorts of solid or liquid substances suspended in the air. They block the stomata of plants and prevent the gaseous exchanges between plants and atmosphere. They may also change the climate of an area. Aerosols reduce primary productivity by destroying leaf tissue, premature leaf fall, reducing crop yeilds.

(ii) **Biological Indicators :** Some plants are sensitive to certain air pollutants. These plants are used to indicate the presence of these substances. These plants are called biological indicators. *e.g.*,

(a) The tissues present in the tip of dusheri mango turns black when they are exposed to sulphur dioxide (SO_2) fumes.

(b) Pinto beans and *Petunias* are used to indicate the presence of peroxy acetyl nitrate (PAN).

(c) Tobacco and annual blue–grass plants are used to show the presence of ozone (O_3). Lichens are biological indicators of air pollution caused by SO_2.

(iii) **Ecological effects of air pollution**

(a) **Death :** When air is polluted with poisonous gases, death comes as a result immediately. Bhopal episode is a good example. Bhopal episode – On 2nd December 1984 about 3000 human beings died, due to the leakage of methyl isocyanate (toxic gas) into the air from an insecticide plant managed by Union Carbide Corporation.

(b) **Chlorosis :** The disappearance of chlorophyll is called chlorosis. It is caused by SO_2, nitrogen dioxide, ozone and fluorides.

(c) **Necrosis :** The breakdown of cells is called necrosis. It is caused by SO_2, nitrogen dioxide, ozone and fluorides.

(d) **Green house effect :** The green house effect was first described by the French Mathematician J. Fourier in 1827. Due to heavy industrialization and transportation (modernization), CO_2 concentration is increasing day by day in the atmosphere. CO_2 has capacity of absorbing heat radiations and thus increases temperature. This increase in global temperature (global warming) is mainly due to CO_2 concentration is called green house effect. According to Holmes et. al, (1993), the USA is responsible for the largest portion of man made contributions to the green-house effect (21%), followed by Russia (14%), European contries (14%), India (4%) and the rest of the world (36%).

Besides CO_2, other important gases associated with green house effect are CH_4 (mathane), oxides of nitrogen (NO_x), *CFC* (chlorofluorocarbons) and O_3 (ozone) and these called 'green house gases'.

Relative contribution of these gases to global warming are

CO_2	–	50%
CFC	–	20%
Methane (CH_4)	–	16%
Ozone (O_3)	–	8%
Nitrous oxide	–	6%

It is estimated that by the end of 2100 A.D., atmospheric temperature will be increased by 1-5°*C*. As a result of increase in global temperature, the ice caps will melt and whole earth will be under water.

(e) **Crop losses :** Heavy loss of crop is caused by smog. Smog denotes a combination of smoke and fog. The important components of smog are ozone and PAN (peroxy acetyl nitrate). They damage leafy vegetables, cereals, textile crops, ornamental plants, fruits and forest trees.

(f) **Deterioration of buildings :** SO_2 has also adverse effect on buildings, sculptures, painted surfaces etc, where it causes discolouration and deterioration. Yellowing and blackening of Taj Mahal at Agra is due to SO_2 and other pollutants released by Mathura refinery which is called 'Stone cancer.'

(g) **Respiratory disorders :** Excessive ethylene accelerates respiration causing premature senescence (old age) and abscission (accumulation of yellow fluid (pus) in the body). Aldehydes irritate nasal and respiratory tracts. Chlorine and phosgenes (carbonyl chloride) cause pulmonary oedema. Bronchitis is another bad effect of air pollution.

(h) **Nausea :** H_2S smells like rotten eggs and causes nausea.

(i) **Vomiting :** SO_2 causes vomiting.

(j) **Jaundice :** Arsines induce RBC breakdown and jaundice.

(k) **Oxygen carrying capacity :** *CO* reduces O_2 carrying capacity of RBC by its permanent combination with haemoglobin.

(l) **Coughing :** Coughing is induced by phosgenes (carbonyl chloride).

(m) **Headache :** SO_2 causes headache.

(n) **Cancer :** Cancer is caused by air pollutants like ash, soot, smoke, chromium, nickel and radioactive elements.

(o) **Mutation :** Radioactive elements produce mutation. Ozone produces chromosomal aberrations.

(p) **Cardiac diseases :** Cadmium causes high blood pressure and heart diseases.

(q) **Pneumonia :** Pneumonia is caused by breathing in too much of manganese particles.

(r) **Silicosis :** It is caused by inhalation of dust containing free silica or silicon dioxide especially by workers engaged in mining, ceremic industry, sand blasting and construction industries.

(s) **Depletion of Ozone umbrella :** In the atmosphere, about 30 *km* above the surface of the earth, the ozone molecules (O_3) form an umbrella. It prevents the penetration of harmful ultra violet radiation from the sun and thus protects the life of the earth. It is now feared that there is danger of depletion of the ozone umbrella, which may occur by the use of freons and other CFC-compounds in refrigerants, coolants in domestic refrigerators and cold storage facilities, and as filling agents in the form of plastics and in aerosol packages. On reaching the ozone umbrella, they destroy ozone molecules as a result of photochemical reactions. Over the past 16 years, the density of the ozone layer has been diminishing at an average rate of 3%. It is calculated that the depletion of ozone layer by 1% results in an increase in the incidence of skin cancer by 5% to 7%. A hole in O_3 layer has been discovered in Antarctica.

(t) **Acid rain :** One of the major environmental issues facing human society at the national and international level is the problem of rain water having low *pH*. The rainwater is always slightly acidic as CO_2 in the atmosphere gets dissolved in it. However during recent years, it has been noted a further lowering of *pH* of rain water often as low as 2.4. This lowering of *pH* is due to the dissolution of acids in the rain water. Precipitation of oxides of sulphur and nitrogen with rain is termed acid rain. Acid rain is caused by air pollution. When atmospheric air contains sulphur dioxide (SO_2) and oxides of nitrogen such as nitrous oxide (N_2O) and nitric oxide (NO), they dissolve in rain water forming sulphuric acid and nitric acid. The rain water falls as acid rain. Ingredients of acid rain are 65% H_2SO_4, 30% HNO_3 and 5% HCl.

Acid rain affects both materials and organisms. It attacks building materials principally sandstone, limestone, marble, steel and nickel. In plants, it leads to chlorosis (gradual yellowing in which the chlorophyll making mechanism is impeded) or depigmentation of leaves.

Acid rain increases the acidity of lakes and rivers. Vast tracts of forests and lakes in Europe and North America have been destroyed by acid rain. Acidity kills fish, bacteria and algae and the aquatic ecosystem collapses into sterility leaving a crystal clear but ultimately a dead lake.

(iv) **Control of air pollution**

(a) The emission of exhaust from automobiles can be reduced by devices such as positive crankcase ventilation valve and catalytic converter.

(b) Electrostatic precipitators can reduce smoke and dust from industries.

(c) Gaseous pollutants arising from industries can be removed by differential solubility of gases in water.

(d) A fine spray of water in the device called scrubber can separate many gases like NH_3, SO_2, etc. from the emitted exhaust.

(e) Vehicles based on compressed natural gas (CNG) should be introduced.

Controlling vehicular air pollution A case study of Delhi : There are more petrol driven vehicles in Delhi. Significant high levels of lead were found at many places. The safety level for residential areas ranges from 100 ppm to 150 ppm. It is estimated that over 400 kg of lead are released into Delhi's air everyday. The Supreme Court directed the government to take appropriate measures for reducing pollution caused by automobiles through :

- Switch over of public transport from diesel/petrol to CNG.
- Phasing out of old vehicles.
- Compulsory use of unleaded petrol and reduced sulphur content of diesel.
- Compulsory regular check up of pollution emission of vehicles and enforcement of Euro II norms.

Delhi became the first city of the world to use CNG for its public transport system and autorickshaws by the end of 2002. CNG (compressed natural gas) is a better fuel than petrol or diesel because it is cheaper, burns more efficiently, does not produce much pollution.

(2) **Water pollution :** Water pollution is degradation of quality of water due to addition of substances (*e.g.*, silt), chemicals (*e.g.*, metals, inorganic and organic chemicals) or factors (*e.g.*, heat) and deprivation that makes it a health hazard, unfit for human use, use by animals and industries as well as growth of aquatic biota. Water pollutants belong to three categories – biological, chemical and physical.

(i) **Biological :** Various pathogens, *e.g.*, viruses, bacteria, protozoa, helminthes, algae.

(ii) **Chemical :** Organic wastes, organic biocides (*e.g.*, DDT, BHC) and polychlorinated biphenyls (PCBs), inorganic chemicals like *As, Pb, Cd, Ni, Hg*, phosphates, nitrates, fluoride, etc.

(iii) **Physical :** Hot water, oil spills.

- Water pollution is of both types natural and anthropogenic.

Natural water pollution : It is water pollution caused by natural processes of soil erosion and addition of clay or silt, run off and leaching.

Anthropogenic or Man-made pollution : It is water pollution caused by human activities like industrial effluents, domestic sewage, waste from animal sheds and slaughter houses, detergents, pesticides and fertilizers, oil spills, etc.

(i) **Causes of water pollution**

(a) **Domestic sewage :** Domestic sewage consists of human faeces, urine, and the dirty used–up water in houses. It contains a large number of bacteria and virus. The sewage is released into the rivers on the banks of which most of the cities are situated. Domestic waste contains biodegradable pollutants. The high amount of *E. coli* in water is the indicator of sewage pollution.

(b) **Industrial effluents :** All industrial plants produce some organic and inorganic chemical wastes. Those nonusable chemicals are dumped in water as a means of getting rid of them. The industrial wastes include heavy metals (*Hg, Cu*, lead, zinc etc), Detergents, Petroleum, Acids, Alkalies, Phenols, Carbonates, Alcoholcyanides, Arsenic, Chlorine, etc.

(c) **Thermal pollution :** Hot effluents and hot water (*e.g.*, thermal plants/atomic reactors) bring about rise in water temperature. Warm water contains less oxygen, has lower rate of putrescibility resulting in increased organic loading, replacement of green algae by blue-green ones. Many animals fail to reproduce *e.g.*, Trout, Salmon.

(d) **Run off from Agricultural fields :** It is of three types – animal wastes, fertilizers and pesticides. Phosphate pollution is caused by sewage and agricultural fertilisers.

(e) **Radioactive wastes :** Liquid radioactive wastes are released into the sea around nuclear installations. The oceanic currents carry the radioactive contaminants every where.

(f) **Oil pollution :** Oil is a source of pollution in sea-water. Oil pollution is due to ship accidents, loading and discharging of oil at the harbour, oil refineries and off-shore oil production. Degree of impurity of water due to organic matter is measured in terms of BOD (Biochemical Oxygen Demand). It is the demand for O_2 to decompose organic wastes in litre of water.

(g) **Eutrophication :** Rich growth of micro-organisms consumes most of the dissolved oxygen, so as to deprive other organisms. It generally occurs at the bottom layers of deep lakes. Addition of excessive plant nutrients intensifies eutrophication. It harmful to fish and other aquatic life..

(ii) **Effect of water pollution**

(a) **Chemical pollutants**

- Many chemicals present in industrial effluents are poisonous causing various types of deformities, *e.g.*, mercury (minamata disease first reported in 1952 due to eating of fish captured from *Hg*-contaminated Minamata Bay of Japan), lead (plumbism), cadmium (itai-itai, ouch-ouch, first reported in 1947 in Toyoma city of Japan). nickel, arsenic, chromium, etc.
- Some chemicals like acids contained in industrial effluents are corrosive. They damage water treatment plants.
- Persistent pesticides enter food chains, undergo biomagnification and harm the aquatic life as well as land animals dependent on it.
- Organic sulphur inhibits nitrification.

(b) **Odour :** Free chlorine, ammonia, hydrogen sulphide, phenols, growth of algae and microorganisms produce unpleasant odour.

(c) **Turbidity :** Water becomes muddy or turbid due to suspension of mineral dust, silt and related colloidal particles. Turbidity hinders penetration of light. It causes clogging of gills in fishes. Therefore, both plant and animal life is destroyed.

(d) **Colour :** Dyes, iron and chromium compounds and anaerobic decomposition cause colouration of water.

(e) **Taste :** It is impaired due to occurrence of pollutants like free chlorine, phenol, iron, manganese, detergents, hydrocarbons, oils and decomposition products.

(f) **Oil pollution :** It comes from spills of oil refineries, oil wells and washing of oil tankers. Oil spreads over water, kills plankton, neuston, necton, water birds and other organisms.

(g) **Scum and Sludge :** They are produced by organic wastes especially H_2S is produced by them. The sulphide combines with metallic ions and form brownish or blackish substance that float over and inside water.

(iv) **Control of water pollution :** Pollution control by sewage treatment includes the following steps :

(a) **Sedimentation :** When sewage is allowed to stand, the suspended particles settle to the bottom. So by sedimentation the suspended particles are removed from sewage.

(b) **Dilution :** The sewage can be diluted with water. This increases the O_2 content and reduces BOD and CO_2.

(c) **Waste stabilization pond or Oxidation pond :** Domestic and industrial wastes are stored in a dilute condition in shallow ponds called oxidation or stabilization ponds. After a few days micro-organisms and algae flourish. The micro–organisms decompose the organic wastes by oxidation, and the water is purified. This water is rich in nitrogen, phosphorus, potassium and other nutrients. This water can be used for fish culture, agriculture etc.

A Case Study of Integrated Waste Water Treatment : Wastewater including sewage can be treated in an integrated manner, by utilizing a mix of artificial and natural processes. An example of such an initiative is the town of Arcata, situated along the northern coast of California. The townspeople created an integrated waste water treatment process within a natural system. The cleaning occurs in two stages – (a) The conventional sedimentation, filtering and chlorine treatments are given. After this stage, lots of dangerous pollutants like dissolved heavy metals still remain. (b) The biologists developed a series of six connected marshes over 60 hectares of marshland. Appropriate plants, algae, fungi and bacteria were seeded into this area, which neutralize, absorb and assimilate the pollutants. Hence, as the water flows through the marshes, it gets purified naturally.

(3) **Soil pollution or Land pollution (Agrochemicals and their effects):** It is alteration in soil caused by removal or addition of substances and factors which decreases its productivity, quality of plants and ground water.

Negative soil pollution : It is reduction in soil productivity due to erosion and over use.

Positive soil pollution : It is reduction in soil productivity due to addition of undesirable substances.

Soil pollution is direct if the pollutants are passed over it directly *e.g.*, industrial effluents, fertilizers. It is indirect if the pollutants reach soil from other resources like air and water, *e.g.*, acid rain.

(i) **Land pollutants :** Manure, crop–residues, ashes, cinders (pieces of coal), garbage (waste food), paper, card board and plastics. Plastics are the most important land pollutants. Rubber, leather, cloth, rubbish, bricks, sand, metal, broken glasses, demolished building, dead animals, discarded furniture, automobiles, insecticides, herbicides and other biocides and radioactive elements are some of the important land pollutants. The main sources of land pollution are pesticides, radioactive elements and fertilizers.

(a) **Pesticides :** Pesticides are chemicals used to kill pests like insects, rats, snails, fungi, herbs, etc. They are collectively called biocides because they kill life.

Ecological effects of pesticides

- **Mutation :** Insecticides induce gene mutation in human beings (Wurster, 1974).
- **Cancer :** DDT produces cancer in human tissues.
- **Congenital birth defects :** Certain herbicides like diozan increase birth defects in both people and livestock.
- **Sex hormones :** DDT affects sex hormones in mammals and birds.
- **Decline of reproduction :** In Bermuda petral, a sea bird, the rate of hatching of eggs is much reduced because of the accumulation of DDT. If the accumulation increases further, there will be failure of reproduction in this species in future.
- **Calcium metabolism :** DDT interferes with calcium metabolism resulting in calcium deficiency. DDT causes hormonal disturbance resulting in delayed ovulation and inhibition of gonad development.
- **Biomagnification :** The pesticides are non–degradable. They have much affinity towards fat. Hence they tend to move into the living organisms. They are concentrated as they pass up the food chains. For example, at each trophic level, the accumulation of insecticides increases by 10 times. For example if the goat gets one part per million (PPM) of DDT from the grasses, it will have 10 ppm in its tissues. The man, eating the goat will have 100 ppm. The man-eating tiger will have 1000 ppm. If the food chain is still greater, the accumulation will still be higher. This increasing accumulations of insecticides in higher organisms is called biomagnification or biological amplification. DDT causes the pollution of air, water and soil.

(b) **Fertilizers :** Excessive use causes soil deterioration through decrease of natural microflora. Leaching down causes pollution of underground water (third poison). Salts entering crop plants in excess may prove harmful.

- Excessive use of nitrogen fertilizers has increased levels of nitrates in soil, which is responsible for **'blue baby syndrome'**. From soil, these nitrates go to leaves and fruits and then to human beings. In alimentary canal, bacteria convert nitrates into toxic nitrites, which combine with haemoglobin of blood to form **methaemoglobin** due to which oxygen transport is reduced.

(c) **Industrial wastes and chemicals :** Industrial wastes and effluents are often dumped over soil. They contain several heavy metals like nickel, chromium, aluminium, tin, copper, zinc, cadmium, toxic chemicals like cyanides, acids and alkalies, dyes, organic solvents, etc. The chemicals become part of soil. They harmfully affect plant growth and soil biota. Both ground water and nearby water bodies are polluted through leaching and run-off.

(d) **Mining wastes :** They include mine dust, rock tailings, slack and slag. Open cast mining (surface dug out to bring out mineral deposit) completely spoil the surrounding soil. Toxic metals and chemicals present in the mining wastes destroys vegetation and produce many deformities in animals and human beings.

(e) **Radionuclides :** They are present in ores, coal, waste of mineral purification and uranium mines, etc. A lot of radio-isotopes are also used in research and medicine. Despite best precautions some radionuclides constantly enter soil and are transferred to food chain.

(f) **Manures :** They are prepared from garbage, sewage sludge and excreta of livestock. The manures carry a lot of pathogens. They contaminate soil and crops. From crops, the pathogens are transferred to domesticated animals and human beings.

(ii) **Control of soil pollution**

Soil pollution caused by solid wastes can be corrected by the following methods.

(a) **Salvage :** Articles which can be recycled should be removed from garbage, *e.g.*, metals, glass, polythene, paper, rags, etc. It provides employment to rag pickers and helps in recycling of wastes.

(b) **Construction material :** Flyash is being converted into bricks for construction work. Flyash, industrial effluents containing toxic chemicals and hazardous metals can be used as bedding material for road construction.

(c) **Dumping (Landfilling) :** Dumping is piling of waste on selected low lying land. It is of two types, open and sanitary.

(d) **Pyrolysis :** The waste is heated anaerobically at a temperature of 1650°C. It yields industrial gas, alcohols and a number of other chemicals. The bulk of the waste is reduced. Residue is disposed off in land-fill.

(e) **Burning :** This is a common method for reducing bulk of wastes. Rubbish and garbage are commonly burnt in open spaces. It, however, releases offensive odour and smoke.

(f) **Incineration :** Waste is burnt aerobically at 900-1000°C. The hot gases and smoke are further passed into a chamber where the temperature is 1300°C. It burns the smoke particles. The gases released from the second chamber are taken to wet scrubber for removing suspended particles and soluble gases. Ash formed in incinerator is collected and disposed off in land filling.

(g) **Recycling of wastes :** Paper, glass, polythene and metals can be recycled. Though paper recycling is a bit costlier, it saves a lot of wood. For example one tonne of recycled paper saves 17 medium sized trees from felling. Recycling of metals not only saves the scarce resource but is also cheaper and less polluting.

(h) **Agricultural wastes :** Instead of burning or manuring them, they can used for preparation of industrial paper, cardboard, hardboard, poultry feeds, etc.

(i) **Pesticides and Fertilizers :** Their use should be reduced by resorting to biological control (for pests) and organic farming.

(j) **Biogas plants :** Cow dung, human excreta and putrescible garbage can be mixed and used for generation of biogas. Manure is produced as a by-product.

(k) **Sludge :** Sludge obtained from sewage treatment plants can be used in thermal power plants along with coal.

Case study of organic farming :

❑ Integrated organic farming is a cyclical, zero-waste process, where waste products from one process are cycled in as nutrients for other processes. This allows the maximum utilization of resource and increases the efficiency of production.

❑ Ramesh Chandra Dagar, a farmer in Sonipat, Haryana, includes bee-keeping, dairy management, water harvesting, composting and agriculture in a chain of processes, which support each other and allow an extremely economical and sustainable venture.

❑ There is no need to use chemical fertilizers for crops, as cattle excreta (dung) are used as manure. Crop waste is used to create compost, which can be used as a natural fertilizer or can be used to generate natural gas for satisfying the energy needs of the farm.

❑ He has created the Haryana Kisan Welfare Club regarding this.

(4) **Radioactive pollution :** It is degradation of environment due to release of radioactivity (emission of α-particles, β-particles and gamma rays) by changes in nuclides of unstable/radioactive elements causing short-range and long range harmful effects on living beings including humans. Radioactivity is measured in units called roentgens or *r*.

(i) **Types of radiations**

(a) **Background radiation :** It is radiation level found naturally in biosphere due to cosmic rays reaching earth and radio-nuclides found in earth's crust. Maximum background radiation is found in Kerala beach where 75% of thorium deposits of the world are found.

(b) **Man-made radiations :** They are due to mining and refining of radioactive elements like Plutonium, Uranium and Thorium, nuclear power plants and fuels, preparation of radio-active isotopes, production and explosion of nuclear weapons.

Nuclear weapons : Radiations are released during atmospheric testing of nuclear weapons and their actual use. Atmospheric testing of nuclear weapons has been banned because of release of destructive radiations. Nuclear weapons use uranium-235 and plutonium-239 for fission (atom bomb) and additional hydrogen or lithium for fusion (hydrogen bomb). A nuclear explosion gives rise to –

Radioactive gaseous matter rising up as a mushroom like cloud that disperses later on to spread radioactivity far and wide, polluting air, water and soil of all the places. Radioactivity passes into food chains and affects the whole biota.

Atomic reactors : They employ controlled radioactive fission fusion for liberation of energy.

❑ The coolant water causes thermal pollution.

❑ Small amount of radioactivity enters coolant water which undergoes biomagnification to some 75000 times in birds.

❑ Mishaps do occur in nuclear reactors. One of the causes is core melting, *e.g.*, Chernobyl in Ukraine (26 April 1986).

Radio-Isotopes : They are used in research (*e.g.*, metabolic pathways, induction of mutations in plants and microorganisms, radiotherapy, etc.) *e.g.*, Co-60, P-32, C-14, I-125.

X-rays : They are employed for detecting diseases of lungs, heart, kidneys, joints and fractures. Repeated exposure to X-rays is harmful. Radiologists are prone to radiation disorders.

Other exposures : Workers engaged in radioactive mineral extraction, fuel processing, nuclear power plants, irradiation plants, etc. are always at risk of exposure to radiations.

This pollution occurs through radiations. Radiations are of two types.

❑ **Non ionising radiations :** UV rays, IR rays, etc. UV rays cause skin burning, IR rays increase atmospheric temperature and leads to the green house effect.

❑ **Ionising radiation :** $X-$rays, β-rays, γ-rays, $x-$rays cause genetic injury on mutation.

Types of ionizing radiations : Radioactive isotopes release three types of radiations :

❑ **Alpha particles :** These are large particles emitted by radioactive isotopes (as U^{238}). They travel only short distances. They cannot penetrate the organisms. They cause ionization.

❑ **Beta particles :** These are small particles emitted by radioactive isotopes. They can travel long distances. They can easily penetrate the body tissues and cause ionization.

❑ **Gamma rays :** These are short wavelength rays emitted by radioactive isotopes. They can travel long distances. They can easily penetrate the body tissues and cause ionization. On the basis of the biological effects produced, the radioactive radiations can be grouped into two types, namely internal emitters and external emitters.

(ii) **Harmful effects :** They were first recorded in 1909 in uranium miners as skin burns and cancers. Many plants are killed even at low level of radioactivity. Young and recently divided cells are more easily damaged. The most adverse effect of radioactive pollutant is gene mutation.

(a) **Short range effects :** Loss of nails and hair, subcutaneous bleeding, changed proportion of blood cells, changed metabolism, damage to all organs death in high dose.

(b) **Long Range/Delayed Effects :** Tumours, cancers, mutations, genetic deformities, shorter life span.

(iii) **Control of radiation pollution :** There is no cure for radiation damage. Therefore, the only solution is prevention of radioactive pollution. The various methods are as follows :

(a) **Leakages :** Strict safety measures should be enforced to check leakage of radioactivity from reactors, reactor fuel during its handling and transport, radio-isotopes and radioactive wastes.

(b) **Monitoring :** A regular monitoring of radioactivity should be carried out in all risk areas.

(c) **Accidents :** All measures required to prevent occurrence of accidents should be followed.

(d) **Waste disposal**

- Substances with very low radiation level can be discharged into municipal sewers.
- Low activity wastes should be stored for sometime as to reduce their activity further before final disposal.
- Radionuclides should be separated through precipitation, coagulation or concentration. The concentrated wastes are then changed into glass, ceramic or concrete. This transforms the radioactive waste into non-absorbable and unleachable form. The locked waste is the put in concrete filled drums which are sealed and buried in sea at least 1000 fathoms deep.

(e) **Safety norms :** All safety norms should be strictly followed in copy book style by all workers. This includes wearing of protective dresses.

(5) **Noise pollution :** Noise is unwanted annoying sound of generally 80 dB and above. Audible sound is having intensity of 0 dB. Scooters, Cars etc, have intensity of sound upto 60 dB. Aeroplanes etc, have intensity of sound as 80–100 dB whereas jetaeroplanes have intensity of 120 dB. It is a physical non-persistent pollution which affects the receiver directly. Upto a certain limit, the effect depends upon the mood and upbringing of the person.

(i) **Frequency :** Frequency of sound is measured in cycles per second called Hertz or Hz. Human hearing lies within the frequency of 50–15,000 Hz. Below 50 Hz is infra sound while above 15,000 Hz is ultrasound. Infrasonic sound or infrasound waves cannot be listened but certain body parts resonate at this frequency. Therefore, they can be felt. Infrasound can damage the body parts. Ultrasonic vibrations or ultra sound waves are employed in imaging, cleaning, drilling, cutting, welding and sealing packages.

(ii) **Loudness :** Loudness or sound intensity is measured in decibels or dB.

Table : 10.5-1

Noise Levels (in decibels)		Average noise levels in some major cities	
Threshold of hearing	1	Delhi	90 – 95 dB
Normal breathing	10	Kolkata	100 dB
Whispering	30	Mumbai	80 – 90 dB
Quiet office	40	Kanpur	90 – 100 dB
Homes	45	**Level of noise recommanded**	
Normal conversation	50	Residence	25 – 30 dB
Automobiles	70	Living Room	35 – 45 dB
Heavy Automobiles	100	Library	30 – 40 dB
Jet air craft	150	Bed Room	40 dB
Thunder Clap	120	Class Room	40 – 50 dB
Hooting of trains	130	Hospitals	25 – 35 dB
Rocket Engine	180	Work Shop	55 – 75 dB

(iii) **Sonic boom :** It is a series of shock waves left behind by a supersonic jet flying at a speed of more than one Mach (speed of sound). It produces sudden rattling of windows and doors. Buildings may develop cracks. Startle reaction may appear in human beings and animals.

(iv) **Effects :** Noise brings about :

(a) Damage to ear drum and impairment of hearing (a ten year exposure to 80 dB impairs hearing by 15 dB).

(b) Emotional disturbance, development of anxiety and stress (first effect).

(c) Damage to eye sight, colour perception, night vision, etc.

(d) Hypertension, changes in peripheral circulation and breathing pattern, decreased heart output and gastric problems.

Solid Waste Management : There has been a significant increase in MSW (Municipal Solid Waste) generation in India in the last few decades. This is largely because of rapid population growth and economic development in the country. Solid Waste Management has become a major environmental issue in India. The percapita of MSW generated daily in India ranges from about 100g in small towns to 500g in large towns. Although there is no national level data for MSW generation collection and disposal and increase in solid waste generation over the years can be studied for a few urban centers for example the population of Mumbai grew from around 8.2 million in 1981 to 12.3 million in 1991 registering a growth of around 49% on the other hand MSW generated in the city increased from 3200 tones per day to 5355 tones per day in the same period registering a growth of around 67%. This clearly indicate that the growth in MSW in our urban centers has outpaced the population growth in recent years. This trend can be changing our life styles, food habits and change in living standard. MSW in cities is collected by respective municipalities and transported to designated disposal sites. Which are normally low lying areas of the city.

Solid Waste Management not only comes from industrial units. It also comes from various sources. Every man with the operation of daily domestic work creates solid waste for disposal a study in united state shows that solid waste per person per day in 1920 is 1.2kg. It increases 2.3kg in 1970 and about 5.6kg in 1980. This shows that solid waste per person is mounting due to number of reasons. Solid Waste disposal creates a problem primarily in highly populated areas. The more concentrated the population the greater the problem. City solid waste generated Mumbai 6000 tones per day, Hydrabad 2000 tones per day, Delhi 400 tones per day. In India generation of municipal solid waste, industrial hazardous waste, biomedical waste have been increasing due to 3 factors – population growth, life style changes and economic development. On the other hand waste management responses have not kept pace with the increasing quantities of waste in a high proportion of uncollected waste and poor standards of transportation, storage treatment and disposal. The methods adopted for disposal of solid wastes is a serious health concern with significant environmental, social and health costs associated with it. Open dumping of garbage facilitates the breeding of disease vectors such as flies, mosquitoes, cockroaches, rats and other pest. The poorly maintained landfill sites further a prone to ground water contamination because of leachate production.

Practically every citizen is now search of clear air and pleasant environment. The land pollution problem has grown enormously in the recent years due to waste dumping. Civics administration are facing the problem for hygiene disposal waste. As the cities are growing in size and the problems seen as the generation of plastic waste. Various municipal waste treatment and disposal methods are now being used to try resolving these problems. Garbage generation in household can be recycled and reused to prevent creation of waste at sources and reducing amount of waste thrown into the community dustbins.

Case study of remedy for plastic wastes :

❑ A plastic sack manufacturer in Bangalore has managed to find the ideal solution to the ever-increasing problem of accumulating plastic waste. Ahmed Khan, aged 57 years old, has been producing plastic sacks for 20 years. About 8 years ago, he realized that plastic waste was a real problem.

❑ Polyblend, a fine powder of recycled modified plastic, was developed then by his company. This mixture is mixed with the bitumen that is used to lay roads.

❑ In collaboration with R.V. College of Engineering and the Bangalore City Corporation, Ahmed Khan proved that blends of Polyblend and bitumen, when used to lay roads, enhanced the bitumen's water repellent properties, and helped to increase road life by a factor of three.

❑ Using Khan's technique, by the year 2002, more than 40 kms of road in Bangalore has already been laid. At this rate Khan will soon be running short of plastic waste in Bangalore, to produce Polyblend. Thanks to innovations like Polyblend.

Tips & Tricks

- Maize is the sensitive indicator of fluoride pollution.
- Solonetz : Black alkaline soil.
- Solonchak : White alkaline soil.
- Maximum background radiations are found in kerala beach, where 75% of thorium deposits of the world are found.
- Love canal incidence is associated with dumping of toxic wastes.
- Noise is called a slow killer.
- Mumbai is considered to be the third noisest city in the world.
- Silent spring : Novel written by Rachel Carson (1962) mentioning the effect of DDT on birds. DDT use has been banned in USA since then.
- Gulf War (1990) : Fire from oil wells changed the colour of clouds and rain in north India.
- Prevention and control of pollution Act. 1974.
- National Environment Policy Act. 1969.
- Ganga Action Plan : For controlling pollution in Ganges; started 1985.
- Ecotoxicology : Study of passage of toxic materials in the ecosystems, their transformation, degradation and persistence in various trophic levels.
- Sr-90' is the most dangerous radioactive pollutant.
- I^{131} damage W.B.C., bone-marrows and lymph nodes.
- Faecal Pollution : Indicated by *Escherichia coli*. MPN is most probable number of *E.coli*. It is indicator of water pollution.
- Kyoto Protocol (December 1997) : International conference held in kyoto, Japan obtained commitments from different countries for reducing overall green house gas emission at a level 5% below 1990 level by 2008-2012.

Ordinary Thinking

Objective Questions

Pollution

1. Why is the concentration of ozone less over the north and south poles **[VITEEE 2008]**
(a) CFCs accumulate only in area where the air is cold
(b) CFC use is highest in these areas
(c) CFCs stick to frozen water vapour and are able to act as catalysts
(d) UV rays are stronger in the atmosphere

2. Which of the following strategy is not a correct approach to reduce global warming **[Kerala PMT 2006, 12; NEET 2013]**
(a) Reducing the green house gas emission by limiting the use of fossil fuels
(b) Increase the vegetation cover particularly the forest for photosynthetic utilization of CO_2
(c) Minimizing the use of nitrogen fertilizers in agriculture for reducing N_2O emission
(d) Increasing the use of air conditioners, refrigeration unit and production of plastic foams and propellants in aerosal spray cans
(e) Developing substitutes for chlorofluorocarbons

3. A gas produced by paddy fields and concerned with global warming is **[J & K CET 2008]**
(a) CO_2 (b) Chlorine
(c) H_2S (d) Methane

4. Steps taken by the Government of India to control air pollution include **[CBSE PMT 2009]**
(a) Compulsory mixing of 20% ethyl alcohol with petrol and 20% biodiesel with diesel
(b) Compulsory PUC (Pollution Under Control) certification of petrol driven vehicles which tests for carbon monoxide and hydrocarbons
(c) Permission to use only pure diesel with a maximum of 500 ppm sulphur as fuel for vehicles
(d) Use of non-polluting compressed Natural Gas (CNG) only as fuel by all buses and trucks

5. BOD refers to **[KCET 2015]**
(a) The oxygen required for bacteria to grow in 1 litre of effluent
(b) The amount of oxygen consumed if all the organic matter in 1000 ml of water were oxidized by bacteria
(c) The amount of oxygen released if all the organic matter in 1000 ml of water were oxidized by bacteria
(d) The amount of oxygen released when all the organic matter was consumed by bacteria in 1 litre of water

6. Biochemical Oxygen Demand (BOD) in a river water **[CBSE PMT 1995, 2009; Kerala PMT 2004; AMU (Med.) 2006; AIIMS 2008; AFMC 2009]**
(a) Remains unchanged when algal bloom occurs
(b) Has no relationship with concentration of oxygen in the water
(c) Gives a measure of salmonella in the water
(d) Increases when sewage gets mixed with river water

7. Global agreement in specific control strategies to reduce the release of ozone depleting substances was adopted by **[CBSE PMT 2009]**
(a) Rio de Janeiro Conference
(b) The Montreal Protocol
(c) The Koyoto Protocol
(d) The Vienna convention

8. DDT residues are rapidly passed through food chain causing biomagnification because DDT is **[CBSE PMT 2009]**
(a) Lipo soluble
(b) Moderately toxic
(c) Non-toxic to aquatic animals
(d) Water soluble

9. Which of the following would most likely help to slow down the greenhouse effect **[KCET 2015]**
(a) Converting tropical forests into grazing land for cattle
(b) Ensuring that all excess paper packaging is burned to ashes
(c) Redesigning land fill dumps to allow methane to be collected
(d) Promoting the use of private rather than public transport

10. World Summit on sustainable Development (2002) was held in **[CBSE PMT 2008]**
(a) Argentina (b) South Africa
(c) Brazil (d) Sweden

11. A lake near a village suffered heavy mortally of fishes within a few days. Consider the following reasons for this
(A) Lots of urea and phosphate fertilizer were used in the crops in the vicinity
(B) The area was sprayed with DDT by an aircraft
(C) The lake water turned green and stinky
(D) Phytoplankton populations in the lake declined intially thereby greatly reducing photosynthesis
Which two of the above were the main causes of fish mortality in the lake **[CBSE PMT 2008]**
(a) (A), (C) (b) (A), (B)
(c) (B), (C) (d) (C), (D)

12. For clean environment, which one of the following is not essential **[WB JEE 2012]**
(a) Producer (b) Consumer
(c) Decomposer (d) Polluter

13. Which of the following is not properly matched **[Kerala PMT 2008]**
(a) Formaldehyde – carcinogenic
(b) Sulphur dioxide – respiratory problems
(c) Nitrogen oxide – brown air
(d) Photochemical smog – grey air
(e) Mean annual temperature – 25° C

14. Gaseous pollutants can be controlled by **[Kerala PMT 2008]**
(a) Arrestors (b) Electrostatic precipitators
(c) Pyrolysis (d) Incineration
(e) Adsorption

15. It is estimated that out of the total global warming the relative contribution of $CO_2, CH_4, CFCs$ and N_2O are found respectively as **[CBSE PMT 2008; Kerala PMT 2008, 10; AMU (Med.) 2012]**
(a) 60%, 20%, 14% and 6% (b) 6%, 14%, 20% and 60%
(c) 20%, 60%, 14% and 6% (d) 20%, 14%, 60% and 6%
(e) 14%, 6%, 20% and 60%

16. The amount of freshwater of the earth frozen as polar or glacial ice is **[Kerala PMT 2008]**
(a) 0.5 % (b) 0.02 %
(c) 0.01% (d) 1.97 %
(e) 2.5 %

17. Match the following items in column I with column II and choose the correct answer

Column I		Column II	
A.	Arsenic	1.	Minamata disease
B.	Nitrate	2.	Itai–Itai
C.	Mercury	3.	Blue–baby syndrome
D.	Cadmium	4.	Skeletal fluorosis
E.	Fluoride	5.	Black–foot disease

[HP PMT 2005; Kerala PMT 2006, 07; AIIMS 2007; WB JEE 2010]
(a) A – 2, B – 3, C – 5, D – 1, E – 4
(b) A – 5, B – 3, C – 1, D – 2, E – 4
(c) A – 3, B – 4, C – 5, D – 1, E – 2
(d) A – 5, B – 4, C – 3, D – 2, E – 1
(e) A – 2, B – 5, C – 4, D – 3, E – 1

18. Maximum noise permissible during day time in residential areas **[DPMT 2006]**
(a) 75 dB (b) 55 dB
(c) 65 dB (d) 45 dB

19. Most harmful environmental pollutants are **[Odisha JEE 2009]**
(a) Biodegradable
(b) Corrosive agents
(c) Non biodegradable chemical
(d) All of the above

20. Protective layer of ozone in the atmosphere exists in which layer **[J & K CET 2009; Odisha JEE 2009; CBSE PMT (Mains) 2011; CBSE PMT 2014; WB-JEE 2016]**
(a) Troposphere (b) Lonosphere
(c) Stratosphere (d) Atmosphere

21. Green house effect means **[Odisha JEE 2009]**
(a) Increase in the temperature of earth due to high conc. of NO_2
(b) Increase in the temperature of earth due to high conc. SO_2
(c) Increase in the temperature of earth due to high conc. O_2
(d) Increase in temperature of earth due to high conc. of CO_2

22. Which of the following would appear as the pioneer organisms on bare rocks **[NEET (Phase-I) 2016]**
(a) Lichens (b) Liverworts
(c) Mosses (d) Green Algae

23. If global warming continues, the organism which may face more server threat is **[DUMET 2009]**
(a) Cow (b) Banana
(c) Snow leopard (d) Dolphin

24. One of the following acts as secondary pollutant **[DUMET 2009]**
(a) Br_2 (b) Cl_2
(c) NO_2 (d) HNO_3

25. Kyoto protocol has, specified the commitments of different countries **[DPMT 2006]**
(a) To mitigate climate changes
(b) Limit production of chlorofluorocarbons
(c) To prepare a world climatic programme
(d) None of the above

26. Carbon dioxide is called green-house gas because it is **[DUMET 2009; KCET 2012]**
(a) Used in green-house to increase plant growth
(b) Transparent to heat but traps sunlight
(c) Transparent to sunlight but traps heat (Infrared radiation)
(d) Transparent to both sunlight and heat

27. Which of the following is not a green-house gas **[KCET 2009; AMU (Med.) 2010]**
(a) Water vapour (b) Carbon monoxide
(c) Methane (d) Oxygen

28. Which one of the following is not an air pollutant **[Kerala PMT 2009]**
(a) Pollen from plants (b) Phosphates
(c) Carbon monoxide (d) Hydrocarbons
(e) Sulphur dioxide

29. Which one of the following is a most efficient device to eliminate particulate matters from the industrial emissions or control air pollution **[Kerala PMT 2009; Odisha JEE 2010]**
(a) Cyclonic separators (b) Trajectory separators
(c) Pyrolysis (d) Incineration
(e) Electrostatic precipitator

30. Which of the following are true
(i) Benzene hexachloride is a non biodegradable pollutant
(ii) Anthropogenic air pollutants are natural in origin
(iii) Carbon monoxide is a primary air pollutant
(iv) Sulphur dioxide causes brown air effect during traffic congestion in cities **[Kerala PMT 2009]**
(a) (i) and (iii) only (b) (i) and (ii) only
(c) (ii) and (iii) only (d) (ii) and (iv) only
(e) (i) and (iv) only

31. Match the following and choose the correct combination from the option given below

Column I (Green house gases)		Column II (Concentration in 2000 AD)	
(A)	CO_2	(1)	282 ppt
(B)	CH_4	(2)	316 ppb
(C)	N_2O	(3)	368 ppm
(D)	$CFC + HFC$	(4)	1750 ppb

[Kerala PMT 2009]
(a) (A) — (3), (B) — (4), (C) — (2), (D) — (1)
(b) (A) — (4), (B) — (3), (C) — (2), (D) — (1)
(c) (A) — (2), (B) — (3), (C) — (4), (D) — (1)
(d) (A) — (1), (B) — (4), (C) — (2), (D) — (3)
(e) (A) — (1), (B) — (2), (C) — (3), (D) — (4)

32. Cleaning Environment with biological options such as microbes & plants is called **[VITEEE 2006]**

Or

A process that uses micro-organisms to convert harmful industrial wastes to less toxic or non-toxic compounds is **[AIEEE Pharmacy 2003]**
(a) Bioremediation (b) Biotechnology
(c) Biowarware (d) Incineration

33. Marsh gas mainly contains **[BHU 2008]**
(a) SO_2 (b) CO_2
(c) CH_4 (d) H_2O

34. Which of the following is not a greenhouse gas **[WB JEE 2008]**
(a) N_2O (b) CFC
(c) O_3 (d) SO_2

35. An international treaty known as Montreal Protocol was signed to control emission of **[MHCET 2015]**
(a) UV rays (b) Ozone
(c) CFC (d) Oxygen

36. The Environment (Protection) Act to protect and improve the quality of environment (air, water and soil) was passed by the Government of India in the year **[HP PMT 2005; Kerala PMT 2006; AMU (Med.) 2009, 12]**
(a) 1971 (b) 1974
(c) 1981 (d) 1986

37. Limit of BOD prescribed by Central Pollution Control Board for the discharge of industrial and municipal waste waters into natural surface waters, is **[CBSE PMT 2006]**
(a) $< 100\ ppm$ (b) $< 30\ ppm$
(c) $< 3.0\ ppm$ (d) $< 10\ ppm$

38. Montreal Protocol which calls for appropriate action to protect the ozone layer from human activities was passed in the year **[CBSE PMT 2006]**
(a) 1988 (b) 1985
(c) 1986 (d) 1987

39. Which of the following releases methane **[MP PMT 2013]**
(a) Cattle (b) Termite
(c) Rice fields (d) All of the above

40. According to Kyoto protocol the major nations abide to reduce concentration of green house gases by **[MP PMT 2007]**
(a) 2008 (b) 2010
(c) 2012 (d) 2018

41. Biomagnification of DDT in a aquatic food chain starting from water having a concentration of 0.003 ppb may go, in fish eating birds, upto **[AMU (Med.) 2009, 12]**
(a) 2 ppm (b) 25 ppm
(c) 50 ppm (d) 100 ppm

42. It is said, the Taj Mahal may be destroyed due to **[CPMT 2004]**
(a) Flood in Yamuna river
(b) Decomposition of marble as a result of high temperature
(c) Air pollutants released from oil refinery of Mathura
(d) All the above

43. Which of the following is a water polluting factor **[MP PMT 2000]**
(a) Smoke (b) Industrial waste
(c) Detergent (d) Ammonia

44. Which of the following is normally not an atmospheric pollutant **[CBSE PMT 1992; MP PMT 1993]**
Or
Photochemical smog pollution does not contain **[CBSE PMT 2006]**
(a) Carbon monoxide (b) Carbon dioxide
(c) Sulphur dioxide (d) Hydrocarbons

45. Smog is a common pollutant in places having **[CPMT 1996]**
(a) High temperature
(b) Low temperature
(c) Excessive SO_2 in the air
(d) Excessive ammonia in the air

46. Photochemical smog is caused by a light mediated reaction between **[AMU (Med.) 2009; CPMT 2010]**
(a) NO_2 and unsaturated hydrocarbons
(b) NO_2 and O_3
(c) SO_2 and unburnt hydrocarbons
(d) SO_2 and O_2

47. In a polluted environment, the maximum pollutant will occur in **[AMU (Med.) 2010]**
(a) Primary producers (b) Tertiary consumers
(c) Secondary Consumers (d) Primary consumers

48. The Air (prevention and Control of Pollution) Act was amended in 1987 to include one of the following as pollutant **[AMU (Med.) 2010]**
(a) Water (b) Noise
(c) Dust (d) None of these

49. Bio-indicators are used for **[MP PMT 2007]**
(a) Oxygen demand (b) Air pollution
(c) Mineral present (d) All of these

50. The UN Conference of Parties on climate change in the year 2011 was held in **[AIPMT (Cancelled) 2015]**
(a) South Africa (b) Peru
(c) Qatar (d) Poland

51. DDT is a **[CBSE PMT 1999; MP PMT 2004; AIIMS 2005]**
(a) Non-biodegradable pollutant
(b) Biodegradable pollutant
(c) Antibiotics
(d) None of the above

52. Some effects of sulphur dioxide and its transformation products on plants include **[MP PMT 1998; BHU 1999, 2004; AFMC 2003]**
(a) Chlorophyll destruction (b) Plasmolysis
(c) Golgi body destruction (d) None of the above

53. Rachel Carson's famous book "Silent Spring" is related to **[AIPMT (Cancelled) 2015]**
(a) Noise pollution (b) Population explosion
(c) Ecosystem management (d) Pesticide pollution

54. Indicator plants which can be used to indicate atmospheric pollution by SO_2 are **[CPMT 1994; BHU 2008, 12; WB JEE 2009; AIPMT 2015]**
(a) Lichens like *Usnea*
(b) Grassland like *Deschampsia*
(c) Moss like *Sphagnum*
(d) Climbers like *Cucurbita*

55. Which of the following is not one of the prime health risks associated with greater UV radiation through the atmosphere due to depletion of stratospheric ozone **[AIPMT (Cancelled) 2015]**
(a) Reduced Immune System
(b) Damage to eyes
(c) Increased liver cancer
(d) Increased skin cancer

56. Which one of the following is called as 'indicator species' for polluted waters **[J & K CET 2010]**
(a) *Tubifex* (b) Phytoplanktons
(c) Zooplanktons (d) Prawns

57. Spraying of D.D.T. on crops produces pollution of **[MP PMT 1995, 98]**
(a) Air only (b) Air and soil only
(c) Air, soil and water (d) Air and water only

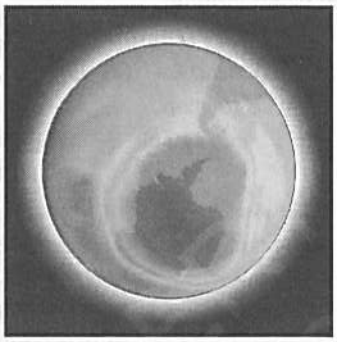
58. Lichens do not like to grow in cities **[CBSE PMT 1993; BVP 2000; MP PMT 2002; BHU 2003; AFMC 2004]**
(a) Because of absence of the right type of algae and fungi
(b) Because of lack of moisture
(c) Because of SO_2 pollution
(d) Because natural habitat is missing

59. Which of the following pollutants is non biodegradable **[MP PMT 2013]**
(a) Mercury (b) Plastic
(c) Cadmium (d) All of the above

60. A location with luxuriant growth of lichens on the trees indicates that the **[CBSE PMT 2014]**
(a) Location is highly polluted
(b) Location is not polluted
(c) Trees are very healthy
(d) Trees are heavily infested

61. A scrubber in the exhaust of a chemical industrial plant removes **[CBSE PMT 2014; KCET 2015]**
(a) Gases like ozone and methane
(b) Particulate matter of the size 2.5 micrometer or less
(c) Gases like sulphur dioxide
(d) Particulate matter of the size 5 micrometer or above

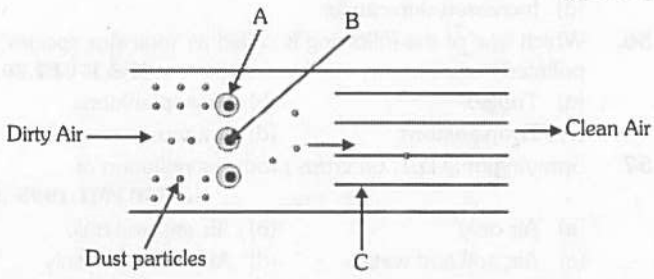
62. Select the right option in which given figure is correctly identified **[NCERT]**



(a) Marsh meadow stage (b) Ozone hole
(c) El Nino Effect (d) Greenhouse effect

63. Green house effect is due to the presence of **[CBSE PMT 1991; CPMT 1998, 99; AIIMS 2000]**
(a) Ozone layer in the atmosphere
(b) Infrared light reaching the earth
(c) Moisture layer in the atmosphere
(d) CO_2 layer in the atmosphere

64. The given figure represents electrostatic precipitator. Select the right option in which A, B and C are correctly identified **[NCERT]**



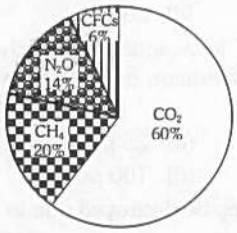
(a) A - Uncharge corona, B - Positively charged wire, C - Collection plate never ground
(b) A - Discharge corona, B - Negatively charged wire, C - Collection plate burnt
(c) A - Discharge corona, B - Positively charged wire, C - Collection plate grounded
(d) A - Discharge corona, B - Negatively charged wire, C - Collection plate grounded

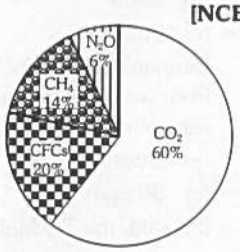
65. Polluted water can be purified by using **[CBSE PMT 1990]**

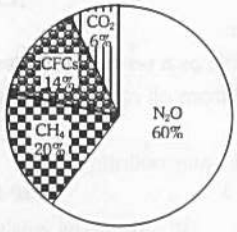
Or

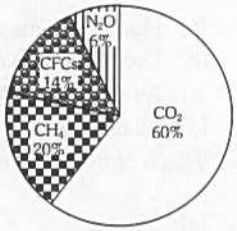
Sewage water can be purified for recycling with the action of **[CBSE PMT 1990]**
(a) Micro-organisms (phytoplankton)
(b) Algae
(c) Pesticides
(d) Fishes

66. The following figures shows relative contribution of greenhouse gases to global warming. Which one is correct **[NCERT]**

(a)


(b)


(c)


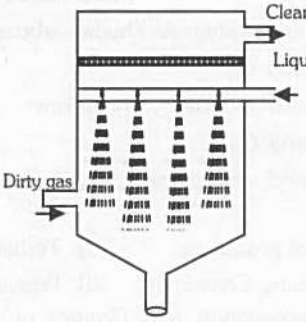
(d)


67. One of the most dangerous radioactive pollutant to *Homo sapiens* is **[CBSE PMT 1995]**
(a) Strontium – 90 (b) Phosphorus – 32
(c) Sulphur – 35 (d) None of the above

68. Which of the following disease is caused or aggravated by pollution
(a) Bronchitis (b) Rheumatism
(c) Scurvy (d) Haemophilia

69. Generally speaking, the atmosphere in big cities is polluted most by
(a) Radioactive fall out
(b) Household waste
(c) Automobile exhaust
(d) Pesticide residues

70. The following shown device is best used to control which of the pollutants according to size of air pollutants, range and types of chemical **[NCERT]**



(a) Fine particles
(b) Dissolved gases
(c) Charged particulate matter
(d) Large particulates

71. Ozone layer in upper atmosphere (stratosphere) is destroyed by or which one of the chemicals is responsible for the reduction of ozone content of atmosphere **[CPMT 1993, 2005, 09; KCET 2000; Pb. PMT 2000; MP PMT 2002, 04, 06, 12; HP PMT 2005; DPMT 2006; BHU 2008]**

Or

What are the chief pollutants of the atmosphere which are most likely to deplete the ozone layer **[CPMT 1995, 98]**

(a) Hydrochloric acid
(b) Photochemical smog
(c) Chlorofluoro carbon (CFC) and Nitrogen Oxide
(d) Sulphur dioxide

72. Consider the following statements with respect to pollution

A. To control air pollution problem by the end of 2002 all the buses of Delhi were converted to run on unleaded petrol
B. Electrostatic precipitator can remove over 99% particulated matter present in the exhaust from a thermal power plant
C. It is possible to estimate the amount of organic matter in sewage water by measuring BOD

Of the above statements **[Kerala PMT 2012]**

(a) A alone is correct (b) B alone is correct
(c) C alone is correct (d) A and B are correct
(e) B and C are correct

73. The pollutants emitted by jet aeroplanes in outer atmosphere flourocarbons are known as **[CBSE PMT 1990; MP PMT 1998; Pb. PMT 1999; MHCET 2001]**

(a) Smog (b) Photochemical oxidants
(c) Aerosols (d) Loess

74. Acid rain is caused due to increase in concentration of (in atmosphere) **[MP PMT 1996, 2002, 10, 12; CPMT 1998; Pb. PMT 2004; Wardha 2005; J & K CET 2005; WB JEE 2011; Odisha JEE 2011; AIPMT 2015]**

(a) SO_2 and NO_2 (b) CO and CO_2
(c) CO and SO_3 (d) O_3 and dust

75. Climate of the world is threatened by **[NEET (Karnataka) 2013]**

(a) Decreasing amount of atmospheric oxygen
(b) Increasing amount of atmospheric carbon dioxide
(c) Decreasing amount of atmospheric carbon dioxide
(d) Increasing concentration of atmospheric oxygen

76. The second commitment period for Kyoto Protocol was decided at **[NEET (Karnataka) 2013]**

Or

The UN conference of parties on climate change in the year 2012 was held at **[AIPMT 2015]**

(a) Durban (b) Bali
(c) Doha (d) Cancun

77. The pollution in city like Delhi may be controlled to great extent **[MP PMT 2010]**

(a) By proper sewage and proper exit of chemicals from factories
(b) By wide roads and factories away from the city
(c) By cleaning city and scanty use of pesticides
(d) All of the above

78. Domestic waste contains **[CBSE PMT 1991; MP PMT 2001]**

(a) Non-biodegradable pollutants
(b) Biodegradable pollutants
(c) Hydrocarbons
(d) None of the above

79. Foul smell in the water of tanks, ponds etc. is due to **[MP PMT 1994]**

(a) Anaerobiosis (b) Aerobiosis
(c) Biological magnification (d) Psammophytes

80. Measurement of the rate of O_2 consumption in unit volume of water over a period of time is done to find out **[MP PMT 1996]**

(a) Biogas generation
(b) Biochemical oxygen demand
(c) Biosynthetic pathways
(d) Fermentation

81. Formation of ozone hole is maximum over **[CBSE PMT 1997]**

(a) India (b) Antarctica
(c) Europe (d) Africa

82. The Air Prevention and Control of Pollution Act came into force in **[NEET 2013]**

(a) 1990 (b) 1975
(c) 1981 (d) 1985

83. Appropriate measures to reduce overall greenhouse gas emissions are the commitments of the **[DUMET 2010]**

(a) Montreal protocol (b) Environment Act
(c) Kyoto protocol (d) Earth Summit

84. The domestic sewage in large cities **[CBSE PMT (Mains) 2012]**

(a) Has a high BOD as it contains both aerobic and anaerobic bacteria
(b) Is processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plants (STPs)
(c) When treated in STPs does not really require the aeration step as the sewage contains adequate oxygen
(d) Has very high amounts of suspended solids and dissolved salts

85. The stratospheric ozone depletion leads to **[AIIMS 1994; NEET (Phase-I) 2016]**

(a) Global warming
(b) Increase in the incidence of skin cancers
(c) Forest fires
(d) All the above

86. Which causes water pollution **[MP PMT 1993]**

(a) 2, 4–D and pesticides (b) Smoke
(c) Automobile exhaust (d) Aeroplanes

87. Select the correct statement **[AIIMS 2012]**

Or

According to Central Pollution Control Board (CPCB), which particulate size in diameter (in micrometers) of the air pollutants is responsible for greatest harm to human health **[NCERT; CBSE PMT 2008]**

(a) Particulate matter of size $10\,\mu m$ can create severe damage to the lungs
(b) Particulate matter of size greater than $2.5\,\mu m$ can get trapped in lungs and cause problems
(c) Particulate matter of size less than $2.5\,\mu m$ penetrate deep into lungs
(d) None of the above

88. Phosphorus-32 emits **[DUMET 2010]**
(a) α – particles (b) β – particles
(c) γ – particles (d) X – rays

89. Photochemical smog is related to the pollution of **[MP PMT 1994]**
(a) Soil (b) Water
(c) Noise (d) Air

90. Eutrophication of water bodies leading to killing of fishes is mainly due to non-availability of **[KCET 1994; CBSE PMT 1996; CPMT 2000; AIIMS 2002; AIPMT 2015]**
(a) Dissolved hydrogen (b) Dissolved oxygen
(c) Mineral salts (d) None of these

91. The toxic effect of carbon monoxide is due to its greater affinity for haemoglobin as compared to oxygen by (approx.) **[CBSE PMT 1995]**
(a) 200 times (b) 2 times
(c) 1000 times (d) 20 times

92. *Taj Mahal* is threatened due to the effect of **[CBSE PMT 1995; BHU 1999; CPMT 2002; RPMT 2005]**
(a) Chlorine (b) Sulphur dioxide
(c) Oxygen (d) Hydrogen

93. This is a nonbiodegradable pollutant **[KCET 2012]**
(a) Sewage (b) Sulphur dioxide
(c) Oxides of nitrogen (d) Lead vapour

94. A dental disease characterised by mottling of teeth is due to presence of a certain chemical element in drinking water. Which is that element **[CBSE PMT 1995]**
(a) Boron (b) Chlorine
(c) Fluorine (d) Mercury

95. In 2002 A.D. according to research the concentration of CFC reached to **[MP PMT 2007]**
(a) 368 ppm (b) 1750 ppb
(c) 261 ppt (d) 326 ppb

96. Find the correct order of biomagnification of DDT in an aquatic food chain **[Kerala PMT 2012; GUJCET 2015]**
(a) Water (0.003 ppm), zooplankton (0.5 ppm), small fish (0.04 ppm), large fish (2 ppm), fish eating birds (25 ppm)
(b) Water (0.003 ppm) zooplankton (0.04 ppm) small fish (0.5 ppm), large fish (2 ppm), fish eating birds (25 ppm)
(c) Water (0.003 ppm), fish eating birds (25 ppm), zooplankton (0.5 ppm), small fish (0.04 ppm), large fish (25 ppm)
(d) Water (0.003 ppm), small fish (0.04 ppm), zooplankton (0.5 ppm), large fish (2 ppm), fish eating birds (25 ppm)
(e) Water (0.003 ppm), large fish (0.04 ppm), small fish (0.5 ppm), zooplankton (2 ppm), fish eating birds (25 ppm)

97. 'Heat islands' are produced due to **[EAMCET 1995]**
(a) Air pollution (b) Water pollution
(c) Land pollution (d) All the above

98. Melanin pigment protects from which of the following radiations **[AFMC 2012]**
(a) UV rays (b) X-rays
(c) Infrared rays (d) Gamma rays

99. In the last decades, most serious nuclear reactor accident created MIC gas tragedy in **[CBSE PMT 1996; BHU 2000]**
(a) Russia (1990) and Bhopal (1996)
(b) Ucraine (1986) and Bhopal (1984)
(c) Bhopal (1994) and Russia (1990)
(d) Ucraine and USA (1984)

100. Which of the following country is responsible for releasing largest amount of green–house gases **[CBSE PMT 1996, 2002; BVP 2002]**
(a) Russia (b) Germany
(c) Brazil (d) America (USA)

101. Which of the following group of gases cause photochemical smog **[Kerala PMT 2007]**
(a) O_3, *PAN* and *CO* (b) *HC*, *NO* and *PAN*
(c) O_2, *PAN* and NO_2 (d) O_2, *PAN* and NO_3
(e) O_3, *PAN* and NO_2

102. Which one of the following statements is correct **[CBSE PMT 2007]**
(a) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies
(b) Both *Azotobacter* and *Rhizobium* fix atmospheric nitrogen in root nodules of plants
(c) Cyanobacteria such as *Anabaena* and *Nostoc* are important mobilizers of phosphates and potassium for plant nutrition in soil
(d) At present it is not possible to grow maize without chemical fertilizers

103. Presently, the main cause of global warming is **[MP PMT 2012]**
(a) Increasing CO_2 concentration
(b) Depletion of ozone layer
(c) Increased energy production by sun
(d) The earth getting closer to sun

104. Air pollution effects are usually found on **[MP PMT 1997]**
(a) Leaves (b) Flowers
(c) Stems (d) Roots

105. Water pollution **[MP PMT 1997; BHU 2002]**
(a) Increases oxygenation
(b) Decreases turbidity
(c) Increases turbidity and deoxygenation
(d) Increases photosynthesis

106. The river 'Sone' receives wastes from **[MP PMT 1997]**
(a) Refinery (b) Distillery
(c) Textile mill (d) Paper mill

107. Oxides of sulphur and nitrogen are important pollutants of **[MP PMT 1997]**

Or

Carbon monoxide is a major pollutant of **[MP PMT 1996]**
(a) Air and water (b) Air
(c) Water (d) Soil

108. Leaf curling is caused by **[MP PMT 1997]**
(a) SO_2 (b) O_3
(c) H_2S (d) CO

109. In coming years, skin related disorders will be more common due to **[CBSE PMT 1997]**
(a) Pollutants in air (b) Use of detergents
(c) Water pollution (d) Depletion of ozone layer

110. Phosphate pollution is caused by **[CBSE PMT 1997]**
(a) Phosphate rock only
(b) Agricultural fertilizers only
(c) Sewage and phosphate rock
(d) Sewage and agricultural fertilizers

111. The most hazardous/dangerous metal pollutant of automobile exhaust is **[KCET 1998, 2000; Pb. PMT 2000; MP PMT 2002, 13; BHU 2008]**

Or

Metal generally present in polluted air is

(a) Mercury (*Hg*) (b) Lead (*Pb*)
(c) Cadmium (*Cd*) (d) Copper (*Cu*)

112. Photochemical smog always contains **[CPMT 1998; BHU 2006]**
(a) O_3 (b) CH_4
(c) CO (d) None of these

113. Which important green-house gas, other than methane, is being produced from the agricultural fields **[CBSE PMT 1998]**
(a) Arsine (b) Sulphur dioxide
(c) Ammonia (d) Nitrous oxide

114. Black-foot disease is caused due to groundwater contaminated with excess of **[Kerala PMT 2007, 08; AFMC 2008]**
(a) Nitrate (b) Fluoride
(c) Arsenic (d) Sulphur
(e) Mercury

115. Noise pollution is created if noise is in excess to **[Pb. PMT 1999]**
(a) 70-75 *dB* (b) 50-60 *dB*
(c) 80-99 *dB* (d) 40-65 *dB*

116. PAN (Peroxyacetyl nitrate) which stops Hill reaction is an important constituent of photochemical smog. It is a **[CBSE PMT 1999; Kerala CET 2002; BHU 2005; CPMT 2010]**
(a) Primary pollutant (b) Secondary pollutant
(c) Natural pollutant (d) Corollary pollutant

117. In domestic sewage, impurities in the form of suspended solids, colloidal materials and dissolved materials, are about **[AMU (Med.) 2012]**
(a) 0.1% (b) 2.1%
(c) 5.0% (d) 10.0%

118. Which of the following is the use of lichens in case of pollution **[CBSE PMT 1992, 99; Kerala PMT 2004; Bihar PMT 2005; WB JEE 2010]**
(a) They treat the polluted water
(b) They act as bioindicators of air pollutions
(c) They promote pollution
(d) Lichens are not related with pollution

119. In 1984, Bhopal gas tragedy was caused due to leakage of **[CBSE PMT 1990, 92, 99; Odisha JEE 1997; RPMT 1997; BHU 1998, 2000; KCET 2004; MHCET 2004; Haryana PMT 2005; MP PMT 2010, 13]**
(a) Sodium monoxide
(b) Sodium thiocyanate
(c) Potassium isocyanate
(d) Methyl isocyanate

120. Green house effect refers to **[CBSE PMT 1999; CPMT 2004]**
(a) Cooling of earth (b) Trapping of UV rays
(c) Production of cereals (d) Warming of earth

121. Which of the following is pollution related disorder **[CBSE PMT 1999]**
(a) Hypertension (b) Leprosis
(c) Silicosis (d) Pneumonicosis

122. Which of the following organism is likely to have more concentration of D.D.T in its body **[CBSE PMT 1999]**
(a) Herbivores (b) Carnivores
(c) Top carnivores (d) Primary producers

123. Increasing of temperature due to scattering of energy is determine by ozone, CO_2 and water vapour, is known as **[Pb. PMT 1999; RPMT 1999; J & K CET 2008]**
(a) Radioactivity (b) Ozone effect
(c) Solar reaction (d) Green house effect

124. Water pollution is caused due to **[Pb. PMT 1999; MP PMT 2000, 03, 06; BHU 2001]**
(a) Sewage and other wastes (b) Industrial effluents
(c) Agricultural discharges (d) All of these

125. Which among the following is likely to have the highest levels of D.D.T. depositions in its body **[BHU 2000; NEET (Phase-II) 2016]**
(a) Eel (b) Crab
(c) Sea gull (d) Phytoplankton

126. The ultimate environmental hazard to mankind is **[BHU 2000]**
(a) Air pollution (b) Water pollution
(c) Noise pollution (d) Nuclear pollution

127. Aerosols reduce primary productivity by **[CPMT 2000]**
(a) Destroying leaf tissue (b) Premature leaf fall
(c) Reducing crop yields (d) All of these

128. Measuring Biochemical Oxygen Demand (BOD) is a method used for **[AIIMS 2003; GUJCET 2007; CBSE PMT (Pre.) 2012; AIPMT (Cancelled) 2015]**
(a) Estimating the amount of organic matter in sewage water
(b) Working out the efficiency of oil driven automobile engines
(c) Measuring the activity of *Saccharomyces cerevisae* in producing curd on a commercial scale
(d) Working out the efficiency of *R.B.Cs.* about their capacity to carry oxygen

129. The most adverse effect of radioactive pollutant is **[MHCET 2000]**
(a) Gene mutation (b) Hepatitis
(c) Polio (d) T.B.

130. The result of ozone hole is **[KCET 2001]**
(a) Acid rain (b) UV radiations
(c) Global warming (d) Green house effect

131. Increase in the concentration of pollutants (toxicant) in higher trophic levels is called **[BHU 2001; Kerala PMT 2010; AIPMT 2015]**
(a) Recycling (b) Eutrophication
(c) Biodegradation (d) Biomagnification

132. What is the intensity of sound in normal conversation **[CBSE PMT 2001]**
(a) 10-20 *dB* (b) 40-60 *dB*
(c) 90-120 *dB* (d) 120-150 *dB*

133. Checking of reradiating heat by atmospheric dust O_3, CO_2 and water vapours is **[MP PMT 2004; KCET 2007]**
(a) Green house effect (b) Solar effect
(c) Ozone layer effect (d) Radioactive effect

134. Which one of the following is a wrong statement **[CBSE PMT (Pre.) 2012]**
(a) Most of the forests have been lost in tropical areas
(b) Ozone in upper part of atmosphere is harmful to animals
(c) Greenhouse effect is a natural phenomenon
(d) Eutrophication is a natural phenomenon in freshwater bodies

135. In an area where DDT had been used extensively, the population of birds declined significantly because **[CBSE PMT (Pre.) 2012]**
(a) Birds stopped laying eggs
(b) Earthworms in the area got eradicated
(c) Cobras were feeding exclusively on birds
(d) Many of the birds eggs laid, did not hatch

136. Which is a green house gas **[MP PMT 2001; CPMT 2009; J & K CET 2010]**
(a) CO (b) CO_2
(c) H_2 (d) N_2

137. Which of the following is biodegradable pollutant **[EAMCET 1995; Pb. PMT 2000, 04; MHCET 2001; MP PMT 2012, 13]**
(a) Sewage (b) Plastic
(c) Polythene (d) DDT

138. Effect of pollution is first marked on **[CPMT 2002; RPMT 2005; BHU 2006]**
(a) Micro-organisms
(b) Green vegetation of an area
(c) Food crop
(d) None of these

139. Green muffler is used against which type of pollution **[AIIMS 2002, 13; AFMC 2012]**
(a) Air (b) Water
(c) Soil (d) Noise

140. Positive pollution of soil is due to **[CBSE PMT 2002]**
(a) Excessive use of fertilizers
(b) Addition of wastes on soil
(c) Reduction in soil productivity
(d) All of these

141. CO is more toxic than CO_2 because **[MHCET 2002]**
Or
Carbon monoxide is a pollutant because **[CBSE PMT 1998]**
(a) It affects the nervous system
(b) It damages lungs
(c) It reduces the oxygen carrying capacity of haemoglobin
(d) It forms acid with water

142. Acid rain is the secondary effect of **[MHCET 2002]**
(a) Water pollution (b) Air pollution
(c) Soil pollution (d) Sound pollution

143. The intensity levels of whispering noise is **[WB JEE 2009]**
(a) 10 – 15 dB (b) 20 – 40 dB
(c) 45 – 50 dB (d) 50 – 55 dB

144. This pollutant causes burning sensation of throat and eyes and vomiting sensation **[GUJCET 2007]**
(a) Hydrogen sulphide (b) Sulphur
(c) Hydrogen cyanide (d) Arsenic substances

145. Effect of pollution is on **[MHCET 2003; VVMC Safdarjung 2004]**
(a) Crossing over (b) Ecological balance
(c) Linkage (d) Mutation

146. Secondary sewage treatment is mainly a **[CBSE PMT (Pre.) 2011]**
(a) Biological process (b) Physical process
(c) Mechanical process (d) Chemical process

147. Gases referred to as "green house gases" are **[BHU 2003; CPMT 2003; RPMT 2006; MP PMT 2013]**
(a) CO_2, O_2, NO_2, NH_3
(b) Chlorofluoro carbon, CO_2 , NH_3 , N_2
(c) CH_4 , N_2 , CO_2 , NH_3
(d) Chlorofluoro carbon, CO_2 , CH_4 , NO_2

148. Which one of the following statements is wrong in case of Bhopal tragedy **[CBSE PMT (Pre.) 2011]**
(a) It took place in the night of December 2/3/1984
(b) Methyl Isocyanate gas leakage took place
(c) Thousands of human beings died
(d) Radioactive fall out engulfed Bhopal

149. A range of loudness of sound of 70-90 decibles is rated as **[AIEEE Pharmacy 2003]**
(a) Very loud (b) Uncomfortable
(c) Painful (d) Quiet

150. CFC are not recommended to be used in refrigerators because they **[DPMT 2003; BVP 2004]**
(a) Increase temperature (b) Deplete ozone
(c) Affect environment (d) Affect human body

151. Which of the following does not occur when the sewage is discharged into water **[DPMT 2003]**
(a) Increase in O_2
(b) Cyanophycean blooms occur
(c) Depletion of O_2 layers
(d) Eutrophication

152. dB is standard abbreviation used for the quantitative expression of **[CBSE PMT (Pre.) 2010]**
(a) A certain pesticide
(b) The density of bacteria in a medium
(c) A particular pollutant
(d) The dominant Bacillus in a culture

153. Biomagnification is highest in **[Odisha JEE 2010]**
(a) Secondary consumers (b) Primary consumers
(c) Producer (d) Decomposer

154. In almost all Indian metropolitan cities like Delhi, the major atmospheric pollutant(s) is/ are **[AIIMS 2003, 08; AIEEE Pharmacy 2004]**
Or
In a coal fired power plant electrostatic precipitators are installed to control emission of **[CBSE PMT 2007]**
(a) Suspended particulate matter (SPM)
(b) Oxides of sulphur
(c) Carbon dioxide and carbon monoxide
(d) Oxides of nitrogen

155. The soil pollutants that affect the food chain and food web by killing micro organisms and plants are **[Kerala CET 2003]**
(a) Pathogens (b) Chemical fertilisers
(c) Agricultural wastes (d) Pesticides

156. Chernobyl tragedy occurred in **[BHU 2003]**
(a) 26th May, 1966 (b) 26th April, 1986
(c) 6th Aug., 1947 (d) 9th May, 1945

157. If a water body is contaminated with a toxicant, its biomagnification will be more marked in **[AMU (Med.) 2012]**
(a) Water (b) Planktons
(c) Small fishes (d) Birds

158. Which of the following is not a pollutant **[MP PMT 2003]**
(a) Hydrogen (b) Carbon dioxide
(c) Sulphur dioxide (d) Carbon Monooxide

159. The pesticide used as preventive measure in buildings is **[MP PMT 2003]**
(a) Aldrin (b) Dieldrin
(c) Endrin (d) DDT

160. Frequent occurrence of water blooms in a lake indicates **[AIEEE Pharmacy 2003]**
(a) Nutrient deficiency
(b) Oxygen deficiency
(c) Excessive nutrient availability
(d) Absence of herbivores in the lake

161. Which of the following pollutant is released in larger quantity from the exhaust emission of a petrol/diesel automobile **[BVP 2004]**

Or

Main air pollutant is **[MP PMT 2003]**

Or

Which of the following is most poisonous **[CBSE PMT 2001]**
(a) CO (b) CO_2
(c) NO_2, SO_2 and Pb (d) Hydrocarbons

162. The noise produced in office is normally at the level of **[AIIMS 2004]**
(a) 20 *db*. (b) 30 *db*.
(c) 40 *db*. (d) 60 *db*.

163. Nitrogen oxides produced from the emission of automobiles and power plants, are the source of line air borne particles which lead to **[AIIMS 2004]**
(a) Photochemical smog (b) Dry acid deposition
(c) Industrial smog (d) Wet acid deposition

164. A river with an inflow of domestic sewage rich in organic waste may result in **[AIIMS 2004; NEET (Phase-I) 2016; NEET (Phase-II) 2016]**
(a) Drying of the lake very soon due to algal bloom
(b) An increase production of fish due to lot of nutrients
(c) Death of fish due to lack of oxygen
(d) Increased population of aquatic food web organisms

165. Minamata disease was caused due to the consumption of **[EAMCET 1995; AIIMS 2004; KCET 2008]**
(a) Sea food containing lot of cadmium
(b) Fish contaminated with mercury
(c) Oysters with lot of pesticide
(d) Sea food contaminated with selenium

166. Match the following and choose the correct combinations from the options given

Column I	Column II
(1) DDT	(p) CO, CO_2
(2) PAN	(q) Smog
(3) Acid rain	(r) Biological magnification
(4) Global warming	(s) SO_2

[Kerala CET 2005]
(a) (1)-(s), (2)-(r), (3)-(q), (4)-(p)
(b) (1)-(p), (2)-(r), (3)-(q), (4)-(s)
(c) (1)-(q), (2)-(r), (3)-(s), (4)-(p)
(d) (1)-(r), (2)-(q), (3)-(s), (4)-(p)
(e) (1)-(r), (2)-(s), (3)-(p), (4)-(q)

167. Which one of the following gases can deplete ozone layer in the upper atmosphere **[BVP 2004]**
(a) Ammonia (b) Methane
(c) Carbon monoxide (d) Sulphur dioxide

168. Odd pollutant amongst the following is **[MHCET 2004]**
(a) SO_2 (b) CO_2
(c) CO (d) Acid rain

169. The term "Bio-magnification" refers to the **[Kerala PMT 2004; Odisha JEE 2011]**
(a) Growth of organism due to food consumption
(b) Increase in population size
(c) Blowing up of environmental issues by man
(d) Increase in the concentration of non-degradable pollutants as they pass through food chain
(e) Decrease in population size

170. In 1984, the Bhopal gas tragedy took place because methyl isocyanate **[CBSE PMT 2004]**
(a) Reacted with CO_2 (b) Reacted with water
(c) Reacted with DDT (d) Reacted with ammonia

171. When domestic sewage mixes with river water **[CBSE PMT (Mains) 2010]**
(a) Small animals like rats will die after drinking river water
(b) The increased microbial activity releases micro-nutrients such as iron
(c) The increased microbial activity uses up dissolved oxygen
(d) The river water is still suitable for drinking as impurities are only about 0.1%

172. Which of the following plant is used for the purification of water **[BHU 2004]**
(a) *Biggiata* (b) *Chlorella*
(c) *Spirogyra* (d) *Eichhornia*

173. Which of the following metal is a water pollutant and causes sterility in human being **[Pb. PMT 2004]**
(a) *As* (b) *Mn*
(c) *Mg* (d) *Hg*

174. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S) distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order **[CBSE PMT 2007]**
(a) SE < S < PE < DE (b) SE < PE < S < DE
(c) PE < S < SE < DE (d) S < DE < PE < SE

175. Eutrophication is caused by **[MHCET 2004]**
(a) Acid rain
(b) Nitrates and phosphates
(c) Sulphates and carbonates
(d) CO_2 and CO

176. Examples of regional pollution are **[DPMT 2004]**
(a) Acid rain (b) Smog
(c) Both (a) and (b) (d) None of these

177. Increase of BOD in water leads to **[WB JEE 2008]**
(a) Increase in the dissolved O_2 concentration
(b) Decrease in the dissolved O_2 concentration
(c) Maintenance of dissolved O_2 concentration at the same level
(d) No effect on dissolved O_2 concentration

178. Kyoto Protocol was endorsed at **[NEET 2013]**
(a) CoP - 4 (b) CoP - 3
(c) CoP - 5 (d) CoP - 6

179. Eutrophication can be observed in **[Wardha 2001; CPMT 2005; CBSE PMT (Pre.) 2011]**
(a) Saline soil (b) Desert
(c) Fresh water lakes (d) Agricultural fields

180. Which one of the following pairs is mismatched **[CBSE PMT 2005]**
(a) Fossil fuel burning - release of CO_2
(b) Nuclear power - radioactive wastes
(c) Solar energy - greenhouse effect
(d) Biomass burning - release of CO_2

181. Which one of the following is not used for disinfection of drinking water **[CBSE PMT 2005]**
(a) Chlorine (b) Ozone
(c) Chloramine (d) Phenyl

182. O_3 is a pollutant gas in **[MP PMT 2010]**
(a) Tropopause (b) Lower stratosphere
(c) Troposphere (d) Mesosphere

183. The ultraviolet radiations in the stratosphere are absorbed by **[J & K CET 2005]**
(a) Ozone (b) Oxygen
(c) Carbon dioxide (d) Sulphur dioxide

184. The BOD of an eutrophied lake will be **[Odisha JEE 2010]**
(a) Higher (b) Lower
(c) Moderate (d) Same as any other lake

185. Which one of the following is not a bioindicator of water pollution **[CBSE PMT 2007]**
(a) Sludge-worms (b) Blood-worms
(c) Stone files (d) Sewage fungus

186. It is used in refrigerator and air conditioners and is a source of Cl^- **[GUJCET 2007; WB JEE 2008]**
(a) Benzopyrene (b) Freon
(c) Benzene (d) CH_4

187. HeLa cells used in cell biology are **[MP PMT 2007]**
(a) Cancerous cells grown in cancer research laboratory
(b) Cervical cancer cell derivatives
(c) Both (a) and (b)
(d) None of these

188. Biochemical Oxygen Demand (BOD) may not be good index for pollution for water bodies receiving effluents from **[NEET (Phase-II) 2016]**
(a) Sugar industry (b) Domestic sewage
(c) Dairy industry (d) Petroleum industry

189. Phenomenon involved in increasing the concentration of non-degradable pollutants in a trophic level of an ecosystem is called **[WB-JEE 2016]**
(a) Biodegradation (b) Biomineralization
(c) Bioaccumulation (d) Biomagnification

NCERT Exemplar Questions

1. Non-biodegradable pollutants are created by **[NCERT]**
(a) Nature (b) Excessive use of esources
(c) Humans (d) Natural disasters

2. In the textbook you came across "Three Mile Island and Chernobyl disasters associated with accidental leakage of radioactive wastes." In India we had Bhopal gas tragedy. It is associated with which of the following **[NCERT]**
(a) CO_2 (b) Methyl Isocyanate
(c) CFC (d) Methyl Cyanate

3. The material generally used for sound proofing of rooms like a recording studio and auditorium is **[NCERT]**
(a) Cotton (b) Coir
(c) Wood (d) Styrofoam

4. Compressed Natural Gas (CNG) is **[NCERT]**
(a) Propane (b) Methane
(c) Ethane (d) Butane

5. World's most problematic aquatic weed is **[NCERT]**
(a) *Azolla* (b) *Wolffia*
(c) *Eichhornia* (d) *Trapa*

6. Which of the following exhibits biomagnification **[NCERT]**
(a) SO_2 (b) Mercury
(c) DDT (d) Both (b) and (c)

7. The expanded form of DDT is **[NCERT]**
(a) Dichlora diphenyl trichloroethane
(b) Dichlora diethyl trichloroethane
(c) Dichlora dipyrydyl trichloroethane
(d) Dichloro diphenyl tetrachloroacetate

8. Which of the following material takes the longest time for biodegradation **[NCERT]**
(a) Cotton (b) Paper
(c) Bone (d) Jute

9. Choose the incorrect statement **[NCERT]**
(a) The Montreal protocol is associated with the control of emission of ozone depleting substances
(b) Methane and carbon dioxide are green house gases
(c) Dobson units are used to measure oxygen content of air
(d) Use of incinerators is crucial to disposal of hospital wastes

10. Among the following which one causes maximum indoor chemical pollution? **[NCERT]**
(a) Burning coal (b) Burning cooking gas
(c) Burning mosquito coil (d) Room spray

11. The green scum seen in the fresh water bodies is **[NCERT]**
(a) Blue green algae (b) Red algae
(c) Green algae (d) Both (a) and (c)

12. The loudness of a sound that a person can withstand without discomfort is about **[NCERT]**
(a) 150 dB (b) 215 dB
(c) 30 dB (d) 80 dB

13. The major source of noise pollution world wide is due to **[NCERT]**
(a) Office equipment
(b) Transport system
(c) Sugar, textile and paper industries
(d) Oil refineries and thermal power plants

14. Match the following and choose the correct option

Column I	Column II
i. Environment Protection Act	A. 1974
ii. Air Prevention & Control of Pollution Act	B. 1987
iii. Water Act	C. 1986
iv. Amendment of Air Act to include noise as an air pollutant	D. 1981

The correct matches is **[NCERT]**
(a) i-C, ii-D, iii-A, iv-B (b) i-A, ii-C, iii-B, iv-D
(c) i-D, ii-A, iii-B, iv-C (d) i-C, ii-D, iii-B, iv-A

15. Catalytic converters are fitted into automobiles to reduce emission of harmful gases. Catalytic converters change unburnt hydrocarbons into **[NCERT]**
(a) Carbon dioxide and water
(b) Carbon monoxide
(c) Methane
(d) Carbon dioxide and methane

16. Why is it necessary to remove sulphur from petroleum products **[NCERT]**
(a) To reduce the emission of sulphur dioxide in exhaust fumes
(b) To increase efficiency of automobiles engines
(c) To use sulphur removed from petroleum for commercial purposes
(d) To increase the life span of engine silencers

17. Which one of the following impurities is easiest to remove from wastewater **[NCERT]**
(a) Bacteria (b) Colloids
(c) Dissolved solids (d) Suspended solids

18. Which one of the following diseases is not caused due to contamination of water **[NCERT]**
(a) Hepatitis-B (b) Jaundice
(c) Cholera (d) Typhoid

19. Nuisance growth of aquatic plants and bloom-forming algae in natural waters is generally due to high concentrations of **[NCERT]**
(a) Carbon (b) Sulphur
(c) Calcium (d) Phosphorus

20. Algal blooms impart a distinct colour to water due to **[NCERT]**
(a) Their pigments
(b) Excretion of coloured substances
(c) Formation of coloured chemicals in water facilitated by physiological degradation of algae
(d) Absorption of light by algal cell wall

21. Match the items in column I and column II and choose the correct option

Column I	Column II
A. UV	i. Biomagnification
B. Biodegradable Organic matter	ii. Eutrophication
C. DDT	iii. Snow blindness
D. Phosphates	iv. BOD

The correct match is **[NCERT]**
(a) A-ii, B-i, C-iv, D-iii (b) A-iii, B-ii, C-iv, D-i
(c) A-iii, B-iv, C-i, D-ii (d) A-iii, B-i, C-iv, D-ii

CT Critical Thinking

Objective Questions

1. Which one of the following statements pertaining to pollutants is correct **[AIIMS 2005]**
(a) DDT is non biodegradable pollutant
(b) Excess flouride in drinking water causes ostoporosis
(c) Excess cadmium in drinking water causes black foot disease
(d) Methyl mercury in water may causes "Itai-Itai disease"

2. The phenomenon in which nutrient enrichment of a water body supports a dense growth of one or many organisms but decreases the species diversity is called **[AMU (Med.) 2005]**

Or

Nutrient enrichment of a lake will cause **[WB JEE 2010]**
(a) Biological magnification (b) Species promotion
(c) Eutrophication (d) None of the above

3. Photochemical smog formed in congested metropolitan cities mainly consists of **[AIIMS 2003, 08]**
(a) Ozone, peroxyacetyl nitrate and NO_x
(b) Smoke, peroxyacetyl nitrate and SO_2
(c) Hydrocarbons, SO_2 and CO_2
(d) Hydrocarbons, ozone and SO_x

4. How carbon monoxide, emitted by automobiles, prevents transport of oxygen in the body tissues **[CBSE PMT 1998]**
(a) By changing oxygen into carbon dioxide
(b) By destroying the haemoglobin
(c) By forming a stable compound with haemoglobin
(d) By obstructing the reaction of oxygen with haemoglobin

5. Under Column – I, a list of gases that are known to have a greenhouse effect' is given. Relate them to their main source selecting from the list given under Column - II

Column – I		Column – II	
A.	Nitrous oxide	1.	Secondary pollutant from car exhausts
B.	Chlorofluorocarbon (CFCs)	2.	Combustion of fossil fuels, wood, etc
C.	Methane	3.	Denitrification
D.	Ozone (O_3)	4.	Refrigerators, aerosol, sprays
E.	Carbon dioxide	5.	Cattle, rice fields, toilets

[Kerala PMT 2007]

(a) A–3, B–4, C–5, D–1, E–2
(b) A–5, B–1, C–3, D–4, E–2
(c) A–4, B–5, C–1, D–2, E–3
(d) A–1, B–3, C–4, D–5, E–2
(e) A–2, B–4, C–5, D–1, E–3

6. Which one of the following is **not correct** as regards the harmful effects of particulate matter of the size 2.5 micro meters or less **[NEET (Karnataka) 2013]**

(a) It can cause respiratory problems
(b) It can directly enter into our circulatory system
(c) It can cause inflammation and damage to the lungs
(d) It can be inhaled into the lungs

7. The component of a living cell affected by the pollutant SO_2 is

(a) Nucleus (b) All cell membrane system
(c) Cell wall (d) Plasmodesmata

8. Acid rain is caused by or recent reports of acid rain in some industrial cities are due to the effect of atmospheric pollution by **[KCET 1994; EAMCET 1995; Pb. PMT 2004; AFMC 2006]**

(a) Excessive release of CO_2 by burning of fuels like wood and charcoal, cutting of forests and increased animal population
(b) Excessive release of NO_2 and SO_2 in atmosphere by burning of fossil fuel
(c) Excessive release of NH_3 by industrial plants and coal gas
(d) Excessive release of CO in atmosphere by incomplete combustion of coke, charcoal and other carbonaceous fuel in paucity of oxygen

9. In Minamata Bay, Japan, which of the following animals remained free from *Minamata disease* **[CBSE PMT 1995; RPMT 2005]**

(a) Cats (b) Rabbits
(c) Dogs (d) Pigs

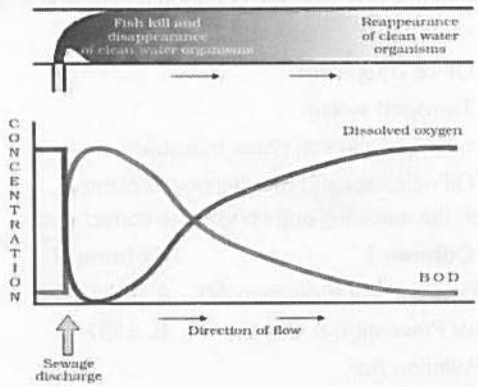
10. Match the following

I.	Mercury	A.	Low blood pressure, blindness
II.	Lead	B.	Hyperkeratosis, Liver cirrhosis
III.	Arsenic	C.	Bone deformation, Testicular atrophy
IV.	Cadmium	D.	Abdominal pain, haemolysis
		E.	Anaemia, consvulsions

[MHCET 2015]

(a) I-E, II-D, III-C, IV-B (b) I-D, II-E, III-B, IV-C
(c) I-C, II-B, III-D, IV-A (d) I-B, II-C, III-D, IV-E

11. Which of the following is correct for the figure given below **[NCERT]**



(a) (A) BOD, (B) Point of sewage discharge, (C) Dissolved oxygen
(b) (A) Dissolved oxygen, (B) Point of treated water discharge, (C) BOD
(c) (A) BOD, (B) Point of treated water discharge, (C) Dissolved oxygen
(d) (A) Dissolved oxygen, (B) Point of sewage discharge, (C) BOD

A R Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion
(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion
(c) If the assertion is true but the reason is false
(d) If both the assertion and reason are false
(e) If the assertion is false but reason is true

1. Assertion : Inhabitants close to very busy airports are likely to experience health hazards.
Reason : Sound level of jet aeroplanes usually exceeds 160 dB. **[AIIMS 2003, 08]**

2. Assertion : Suspended particulate matter (SPM) is an important pollutant released by diesel vehicles.
Reason : Catalytic converters greatly reduce pollution caused by automobiles. **[AIIMS 2005]**

3. Assertion : Presently, the global atmosphere is warming up.
Reason : The depletion of stratospheric ozone layer has resulted in increase in ultraviolet radiations reaching the earth. **[AIIMS 2005]**

4. Assertion : Eutrophication shows increase in productivity in water.
Reason : With increasing eutrophication, the diversity of the phytoplankton increases.

5. Assertion : α, β and γ rays are emitted by disintegration of atomic nuclei of radioactive elements.
Reason : Nuclear fall out is shown by radioactive elements.

6. Assertion : Methylmercury is a highly persistent kind of pollutant that accumulates in food chains.
Reason : Mercury pollution is responsible for Minamata disease.

7. Assertion : Green-house effect is due to thick layer of carbon dioxide.
Reason : The glass panels of a green-house allowing the sunlight to filter through but preventing the heat from being re-radiated in outer space. **[AIIMS 2010]**

Answers

Pollution

1	c	2	d	3	d	4	d	5	b
6	d	7	b	8	a	9	c	10	b
11	a	12	d	13	e	14	e	15	a
16	d	17	b	18	b	19	c	20	c
21	d	22	a	23	c	24	d	25	b
26	c	27	d	28	b	29	e	30	a
31	a	32	a	33	c	34	d	35	c
36	d	37	b	38	d	39	d	40	c
41	b	42	c	43	b	44	b	45	b
46	a	47	b	48	b	49	d	50	a
51	a	52	a	53	d	54	a	55	c
56	a	57	c	58	c	59	d	60	b
61	c	62	b	63	d	64	d	65	a
66	d	67	a	68	a	69	c	70	b
71	c	72	e	73	c	74	a	75	b
76	c	77	d	78	b	79	a	80	b
81	b	82	c	83	c	84	b	85	d
86	a	87	c	88	b	89	d	90	b
91	a	92	b	93	d	94	c	95	c
96	b	97	a	98	a	99	b	100	d
101	e	102	a	103	a	104	a	105	c
106	d	107	b	108	d	109	d	110	d
111	b	112	a	113	d	114	c	115	c
116	b	117	a	118	b	119	d	120	d
121	c	122	c	123	d	124	d	125	c
126	d	127	d	128	a	129	a	130	b
131	d	132	b	133	a	134	b	135	d
136	b	137	a	138	b	139	d	140	d
141	c	142	b	143	b	144	a	145	b
146	a	147	d	148	d	149	a	150	b
151	a	152	c	153	a	154	a	155	d
156	b	157	d	158	b	159	a	160	b
161	a	162	c	163	a	164	c	165	b
166	d	167	b	168	d	169	d	170	b
171	c	172	d	173	b	174	c	175	b
176	c	177	b	178	b	179	c	180	c
181	d	182	b	183	a	184	a	185	c
186	b	187	c	188	d	189	c		

NCERT Exemplar Questions

1	c	2	b	3	d	4	b	5	c
6	d	7	a	8	c	9	c	10	a
11	d	12	d	13	b	14	a	15	a
16	a	17	d	18	a	19	d	20	a
21	c								

Critical Thinking Questions

1	a	2	c	3	b	4	c	5	a
6	b	7	b	8	b	9	b	10	b
11	d								

Assertion and Reason

1	a	2	b	3	b	4	b	5	b
6	b	7	b						

Answers and Solutions

Pollution

6. (d) The degree of pollution is directly proportional to BOD, therefore more the organic pollution (Specially sewage), the more would be BOD of water.

18. (b) In a residential areas during day time 55 dB of sound is permissible.

20. (c) Good ozone is found in the upper part of the atmosphere called the stratosphere and it acts as a shield absorbing UV rays from the sun.

25. (b) International conference held in Kyoto, Japan obtain commitments from different countries for reducing overall green-house gas emissions at a level 5% below 1990 level by 2008-2012.

In Montreal protocol 27 industrialised countries agreed to limit production of chlorofluorocarbons to half the level of 1986..

42. (c) Yellowing and blackening of Taj Mahal at Agra is due to SO_2 and other pollutants released by Mathura refinery.

43. (b) Water pollution is mainly caused by industrial wastes, sewage, insecticide, herbicides, etc.

44. (b) Because carbon dioxide is necessary for photosynthesis in plants and non-harmful for human beings.

51. (a) DDT is a non-biodegradable pollutant. These are persistent pollutants and are not decomposed naturally or by activity of microorganisms and thus are not recycled back into the atmosphere.

52. (a) Plants are more sensitive to SO_2 than animals and man. In most plants chlorophyll pigment destroyed under intense exposure to SO_2 due to conversion of chlorophyll a to Phaeophytin *a*.

55. (c) Increased liver cancer is not related with depletion of stratospheric ozone.

58. (c) Because they are very sensitive to sulphur dioxide and in cities the amount of SO_2 is high so lichen do not grow in cities. This SO_2 causes plasmolysis of algal cells and converts chlorophyll of algae into phaeophytin by removing *Mg*. Phaeophytin results in chlorosis and death of lichen.

60. (b) Lichens are very good pollution indicators, they do not grow in polluted areas.

61. (c) A scrubber can remove gases like SO_2 in which the exhaust is passed through a spray of water or lime.

63. (d) About 50% of increase in earth's temperature is due to CO_2; 20% due to chlorofluorocarbons.

65. (a) Because in the presence of oxygen micro-organisms (Bacteria)oxidise the complex organic components to inorganic forms.

69. (c) Because the number of automobiles in big cities is very high and automobile exhaust have many atmospheric pollutants like *CO*, SO_2 and oxides of lead etc.

71. (c) CFC is strong enemy of ozone and causes depletion of ozone layer.

73. (c) Chemicals released in the atmosphere with force in the form of mist or vapours are called aerosols. Jet aeroplanes release aerosols which contain CFC.

74. (a) The main precursors of acid rain are SO_2 and NO_2 in atmosphere which form H_2SO_4 (Sulphuric acid) and HNO_3 (nitric acid) with H_2O and these come down with rain. Such rains are called acid rains.

76. (c) In Doha, Qatar on 8 December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The second commitment period was from 1st Jan. 2013 to 31st Dec. 2020.

86. (a) Herbicides (*e.g.*, 2, 4-D, 2, 4, 5-T), insecticides (e.g. DDT, aldrin, BHC) and rodenticides causes water pollution.

92. (b) SO_2 combines with atmospheric water vapours to produce acid rains which imparts yellow colour to the white marble.

94. (c) The excess of fluorine in water causes fluorosis. The symptoms of fluorosis are mottling of teeth (yellowish streaks) and abnormal bones liable to fracture etc. It is an example of endemic disease.

99. (b) Bhopal gas tragedy occurred on 3rd Dec. 1984 due to leakage of methyl isocyanate creating air pollution and causing death of about 2500 persons. Chernobyl disastrous tragedy occurred on April 26, 1986 due to explosion at chernobyl nuclear power station resulting huge amount of radioactive clouds in the Ucraine atmosphere.

100. (d) Because USA is the largest consumer of fuel energy.

107. (b) *CO* is major pollutant in air exhausted by various automobiles.

109. (d) In coming years, when the ozone layer becomes thinner or has hole, ultraviolet radiations come directly that causes cancer especially relating to skin like *melanoma*.

110. (d) Man has been releasing large quantities of phosphorus into the biosphere in the form of agricultural fertilizers (Superphosphates) and synthetic detergents.

112. (a) Photochemical smog is formed due to photochemical oxidation (due to action of sunlight) of hydrocarbons and nitrogen oxides. UV light is absorbed by NO_2. This highly energised molecule (NO_2) decomposes into nitric oxide and atomic oxygen. Atomic oxygen reacts quickly with oxygen to form ozone.

113. (d) In addition to CO_2, some other gases also contribute to green house effect. These include ozone, CFCs, nitrous oxides and even methane. Nitrous oxide is produced by denitrifying bacteria acting on artificial fertilizers applied to poorly aerated soils.

116. (b) Pollutant formed by chemical interaction of primary pollutants with atmospheric gas and moisture, often catalysed by sunlight are called secondary pollutants. PAN is one such substance. PAN prevents photolysis of water in photosynthesis or hill reaction.

118. (b) Because lichens are very sensitive to atmospheric pollution (specially SO_2 pollution).

120. (d) Increase in CO_2, CFC, SO_2 and other substances has disturbed the balance between the amount of energy received and that reflected back into the space. This leads to rise in global temperature.

121. (c) Silicosis is caused by inhalation of dust containing free silica or silicon dioxide especially by workers engaged in mining, pottery, ceramic industry, sand blasting, building and construction industries.

123. (d) Reflection of light and heat takes place from plant community and soil. The reflected heat absorb by CO_2 and produces heating in atmosphere. It is known as green house effect.

125. (c) DDT is a non-biodegradable pollutant. This often biologically magnified with their subsequent movement in food chain. Its concentration in 'sea gull' will be highest.

127. (d) Aerosol is produced by jets, aeroplanes, trucks and other vehicles. It can decrease the growth and productivity of plant and also cause abscission of leaves.

128. (a) BOD is a measure of organic matter present in water. It refers to amount of O_2 consumed by microbes to decompose all the organic matter in 1L of water at 20°C for 5 days.

129. (a) Radioactive pollution causes gene mutation. It can change the base sequence of DNA

130. (b) Ozone layer present in stratosphere region. This layer is good ultraviolet radiation absorbent. Due to this property it protects earth from harmful U.V. rays.

133. (a) CO_2 has capacity of absorbing heat radiations and thus increases temperature. It does not allow the heat to radiate back to atmosphere. This increase in global temperature (global warming) which is mainly due to CO_2 concentration is called green house effect. Besides CO_2, other important gases associated with green house effect are CH_4, NO_2, CFC, and O_3.

135. (d) High concentration of DDT disturbs calcium metabolism in birds which caused thinning of eggshell and their premature breaking.

139. (d) Large green plants are planted in high noise pollution zone because they have capacity to absorb sound waves and these green plants for checking noise pollution are known as green muffler.

141. (c) CO is more toxic than CO_2 because it bounds with haemoglobin resultant is less amount of haemoglobin to carry oxygenated blood.

142. (b) Acid rain is the secondary effect of air pollution. The gases like SO_2 and NO_2 concentration is more in the air then these gases mix with the air moisture in clouds and form H_2SO_4 or NHO_3 acids which come down to the earth in the form of acid rain causing much damage to the living organism (plants, animals).

144. (a) Hydrogen sulphide pollutant is eliminated from refineries and chemical industries. They produce burning sensation of throat and eyes and vomitting sensation.

145. (b) Ecological balance is the maintenance of an equilibrium between living components of an ecosystem. So the pollution disturbs the ecological balance.

146. (a) Secondary sewage treatment involves aerobic and anaerobic microbes.

147. (d) These gases causes global warming of atmosphere which is called 'green house effect' and these gases are called green house gases.

149. (a) A range of sound 70-90 decibles is very loud which is generally occurring during heavy traffic on high ways.

150. (b) CFCs reacts with ozone and cause its depletion. That is why CFCs are not recommended to be used in refrigerators.

156. (b) On 26 April, 1986 at the chernobyl power station released a huge amount of radioactive cloud into the atmosphere in which tragedy many peoples were killed.

158. (b) Hydrogen is not a pollutant where as sulphur dioxide and carbon monoxide are the main constituents of atmosphere pollution. CO_2 is not a pollutant at normal concentration but higher concentration of CO_2 cause green house effect.

159. (a) Aldrin is a organochlorine (Chlorinated hydrocarbon) which is added in building foundations to prevent attack of termites.

160. (b) In polluted water nitrogen and phosphorus (from sewage) are accumulated which results in excessive growth of algae on water surface. Excessive growth of algae called water bloom. Due to death and decomposition of organic matter O_2 not available to aquatic animals.

161. (a) CO is released in incomplete combustion of petroleum products and automobiles are responsible for production of 74% of total man made CO in atmosphere. In human beings (carbon monoxide) causes headache and difficulty in breathing. The haemoglobin has greater affinity to CO than oxygen. The $Hb.CO$ reduces the oxygen carrying capacity of haemoglobin.

165. (b) Mercury is very persistent effluent. Higher concentration of Hg causes a serious disease called Minamata disease.

167. (b) Methane (hydrocarbons), aerosols, freon gas and nitrogen oxides destroy ozone layer in upper atmosphere (stratosphere).

171. (c) Any mixing of sewage will increase BOD and decrease of DO due to decomposing activity of microbes.

172. (d) *Eichhornia, Azolla, Lemna, Salvinia,* etc. have potential of environmental clean up because they can tolerate, uptake and even accumulate heavy metals and other toxicants in their cells.

174. (c) Usually, BOD of PE = 30 *mg/lit.*, S = 300-400 *mg/lit.*, SE = 2000–3500 *mg/lit.*, and DE = 3400 *mg/lit.* Therefore PE < S < SE < DE

175. (b) Due to addition of domestic sewage, phosphates, nitrates etc. in water body, the water body become rich in nutrients especially phosphates and nitrates ions, as a result of nutrient enrichment water bodies become highly productive or eutrophic and this phenomena is called eutrophication.

180. (c) Solar energy is not responsible for green house effect instead it is a source of energy for the plants and animals.

188. (d) Biochemical oxygen demand (BOD) is not a good index for pollution for water bodies receiving effluents from petroleum industry

Critical Thinking Questions

2. (c) Eutrophication or nutrient enrichment of water body is basically due to excessive presence of nitrates and phosphates.

4. (c) Carbon monoxide when inhaled combines with haemoglobin more rapidly than oxygen. It blocks the oxygen transport by forming stable compound carboxyhaemoglobin. Its prolonged inhalation may lead to death.

6. (b) The particulate matter of the size 2.5 micro meters or less can indirectly enter into our circulatory system.

8. (b) When SO_2 pollution in air is much higher. Sometimes, SO_2 mixes in the air with small particles of metals near the factories and gets oxidised into sulphur trioxide SO_3. These gases are harmful and they react with water to form sulphuric acid (H_2SO_4) or sulphurous acid (H_2SO_3) and come down to earth with rain water; it is called acid rain or acid precipitation.

9. (b) Minimata disease was caused by eating fish taken from mercury polluted Minimata bay.

Assertion and Reason

1. (a) Noise level upto 64 dB (decibel) is well tolerated. Prolonged exposure to noise level to 80 dB or more leads to loss of hearing ability, fatigue, nervousness, fever, hypertension, gastric disorder, increase in cholesterol level and dilation of pupil of the eye. As the jet aeroplanes have the noise upto 150-160 dB, the inhabitants in the vicinity of busy airports are likely to experience above health hazards. Maximum noise level is recorded in rockets, *i.e.*, 180 dB.

2. (b) SPM (Suspended Particulate Matter) is defined as particles floating in the air with a diameter is below 10 μm. Studies have shown that high SPM concentrations in the air can have a detrimental impact on respiratory organs. SPM is generation from natural sources (e.g., volcanoes or dust storms) and human activities (vehicles, incinerators and industrial plants).

SPM	Other aerosols
Less than 10 μm Tend to float longer in air due to small size	Less than 100μm Tend to settle fairly quickly due to comparative heaviness

Catalytic converters is a devices designed to reduce the amount of emissions from automobiles. The current (so-called three-way) systems use a heated metal catalyst to reduce the emissions of carbon monoxide (CO), hydrocarbons, and nitric oxide (NO), all of which contribute to the formation of photochemical smog. In an automobile's exhaust system, a catalytic converter provides an environment for a chemical reaction where unburned hydrocarbons completely combust. Hence the combustion process continues but outside the engine combustion chamber where no useful energy is extracted. Toxic car gases such as unburned hydrocarbon (UHC) and carbon monoxide (CO) would not exist if the fuel to energy conversion in the engine were perfect.

3. (b) The warming up of global atmosphere present day is due to the increase in green house effect.

Green house effect (GHE) describe the roles of water vapour, CO_2 and other trace gases in keeping the Earth's surface warmer than it would be otherwise. These radiatively active gases are relatively transparent to incoming shortwave radiation (visible spectrum), but are relatively opaque to outgoing reradiating (infrared rays) longwave radiation. The latter radiation, which would otherwise escape to space, is trapped by these gases within the lower levels of the atmosphere.

The subsequent reradiation of some of the energy back to the surface maintains surface temperature higher than they would be if the gases were absent (without the green house effect the Earth's average global temperature would be –18 degree celsius rather than the present 15 degree celsius).There is concern that increasing concentration of the green house gases including CO_2, CH_4, and man made chlorofluorocarbons (CFCS), may enhance the green house effect and cause global warming.

Ozone layer present in the stratosphere is depleted by the aerosols and chloroflurocarbons. Ozone protects the earth from high energy ultra violet radiation.

4. (b) Eutrophication is a natural process which literally means well nourished or enriched. It is a natural state in many lakes and ponds which have a rich supply of nutrients. Eutrophication become excessive, however when abnormally high amount of nutrient from sewage, fertilizers, animal wastage and detergent, enter streams and lakes causing excessive growth or blooms of microorganisms. With increasing eutrophication, the diversity of the phytoplankton community of a lake increases and the lake finally becomes dominated by blue – green algae.

5. (b) The elements that give radiation are called radioactive elements. The radioactive materials are transformed into gases and fine particles which are carried to distant places by wind. When rain drops, the radioactive particles fall on the ground, it is called nuclear fall – out.

6. (b) Mercury pollution has been responsible for several deaths in Sweden and Japan and has caused the Minamata disease in Japan, chlor-alkali plants seem to be chief sources of mercury containing effluents. Mercury is persistent in water it gets changed into water soluble dimethyl form [$(CH_3)_2Hg$] and enters the food chain accompanied by biological or ecological amplification.

7. (b) CO_2 in troposphere behaves like the glass panels of a green-house and allowing the sunlight to filter through but preventing the heat from being re-radiated in outer space. This is so called green-house effect.

Carbon dioxide and water vapours absorb most heat present in atmosphere and add it to the heat which is already present. Thus, the net result is the warming up of the earth's atmosphere.

UNIVERSAL BOOK DEPOT 1960

Environmental Issues

SET Self Evaluation Test

1. Excessive accumulation of organic matter in water bodies leads to **[DPMT 2006]**
(a) Decrease in species diversity
(b) Increase in species diversity
(c) Green house effect
(d) No effect on species diversity

2. U^{238} emits **[BVP 2003]**
(a) *Gamma*–rays (b) *Beta*–rays
(c) *Alpha*–rays (d) None of these

3. Which of the following does not cause pollution **[CPMT 1993, 2002; RPMT 2005]**
(a) Hydroelectric schemes (b) Automobiles
(c) Nuclear energy project (d) Thermal power project

4. Which of the following damages WBC, bone–marrows and lymph nodes
(a) I^{131} (b) Ca^{40}
(c) Caesium (d) Sr^{90}

5. Jaundice is caused by **[MP PMT 1998]**
(a) Contaminated water
(b) Pork
(c) Excessive sugar
(d) Excessive eating of curcuma

6. Which of the following is not a water born disease **[AFMC 1996]**
(a) Asthma (b) Cholera
(c) Amoebiasis (d) None of these

7. Most important causative pollutant of soil may be **[MP PMT 1994]**
(a) Plastics (b) Iron junks
(c) Detergents (d) Glass junks

8. Oxides of sulphur and nitrogen are important pollutants of **[MP PMT 2006]**
(a) Water (b) Soil
(c) Air (d) Both '*a*' and '*c*'

9. In acid rain SO_2 accounts for **[Odisha JEE 2005; AMU (Med.) 2006]**
(a) 70% (b) 100%
(c) 50% (d) 30%

10. Match the items of column I with column II and select the correct option

Column I		Column II	
A.	Electrostatic precipitator	1.	Removes gases like SO_2
B.	Scrubber	2.	Reduces automobile emission
C.	Catalytic converter	3.	Removes particulate matter

[Kerala PMT 2011]
(a) A–2, B–3, C–1 (b) A–3, B–2, C–1
(c) A–1, B–2, C–3 (d) A–3, B–1, C–2
(e) A–1, B–3, C–2

11. Green house effect is caused by **[AFMC 2000; CBSE PMT 2002]**

Or

Which of the following is not ionising radiation
(a) Green plants (b) Infra red rays
(c) UV rays (d) X rays

12. *Escherichia coli* is used as an indicator organism to determine pollution of water with **[CBSE PMT 1998, 2000, 04; CPMT 2001; BVP 2001; VITEEE 2008]**
(a) Faecal matter (b) Heavy metals
(c) Industrial effluents (d) Pollen of aquatic plants

13. 'Ozone day' is observed on **[AIIMS 1996]**
(a) January 30 (b) April 21
(c) September 16 (d) December 25

14. Biomagnification of DDT caused decline in Bird population by **[MP PMT 2011; Kerala PMT 2011]**
(a) Bringing disturbance in calcium Metabolism
(b) Thinning of egg shell
(c) Premature breaking of eggs
(d) All of the above

15. Which one of the following is not a device used to control a particulate matter **[Kerala PMT 2006]**
(a) Arresters (b) Scrubbers
(c) Filters (d) Incinerator

AS Answers and Solutions

1	a	2	c	3	a	4	a	5	a
6	a	7	a	8	d	9	a	10	d
11	b	12	a	13	c	14	d	15	d

1. (a) Organic matter (organic wastes) contains a number of pathogen secondary pollutant pesticides etc. Biological oxygen demand becomes high, and therefore the dissolved oxygen reduced. Hence, planktons, Mollusca and fishes will be eliminated due to reduced dissolved oxygen and presence of secondary pollutants. Some species like annelid worm *Tubifex* and some insect larvae (*Chironomus*) tolerant pollution.

4. (a) I^{131} enter in human body through H_2O or food chain and damage WBC, can cause tumour formation, skin cancer and sterility.

12. (a) The presence of E.coli in the water indicates faecal pollution.

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