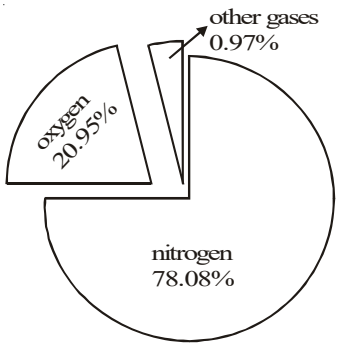
POLLUTION

AIR : The major constituents of air.



Composition of air

Constituent	Percentage by volume
Nitrogen	78%
Oxygen	21%
Carbondioxide	0.03%
Argon	0.94%
Helium	Traces
Neon	Traces
Xenon	Traces
Krypton	Traces
Radon	Traces
Water vapours	Variable
Solidparticles	Variable

Human beings are dependent on the living and non-living components of environment for their survival. But, with the increase in population, human activities have led to deterioration of the quality of environment. For e.g. :

- With increase in population, our living places have become congested and we face the problem of housing.
- More food is needed to feed the increasing population. So we cut forests to make space for the fields to grow crops.
- More and more industries, to manufacture useful products, are developed. These industries release harmful gases in the atmosphere and liquid wastes in water.

All these activities have led to the contamination of our physical environment, namely air, water and soil. As a result, (i) quality of air, water & soil has drastically gone down, and (ii) a large number of plant and animal species have disappeared.

The contamination of our physical environment (air, water and soil) is called pollution, which is a serious problem these days.

Pollution :- Is an undesirable change in physical chemical or biological characteristic of air, water and land which is harmful to man directly or indirectly.

Pollutant :- Is a substance present in the environment in such a concentration that is harmful to the environment and living organisms.

Types of Pollutants

(i) **Gaseous Pollutants :** All pollutants which are in the gaseous state under normal conditions are called gaseous pollutants. e.g., Carbon monoxide, carbon dioxide, Oxides of Sulphur and Nitrogen, Chlorine gas etc.

(ii) **Particulate Pollutants :** Very small particles of solids and liquids suspended in the air are called particulates. Most particulates have particle size ranging from 0.1 micrometer to 10 micrometer. These particles create haziness in the atmosphere and cause air pollution. The inhalation of small particulates over longer periods may cause 'scarring' or 'fibrosis' of the lung lining leading to a disease called pneumoconiosis.

Some common particulates present in the atmosphere (or air) are Dust, smoke, fumes, mist, fly ash, pesticides, insecticides, cement dust, asbestos dust, lead dust, pollen grains, bacteria, fungi, etc.

Although the metallic particles are present in very low concentrations, some of them are very harmful to the living organisms.

The two metals which are extremely harmful to the human beings are lead and mercury.

(iii) **Non-biodegradable Pollutants :** The pollutants which are not broken down to simpler and harmless substances by the action of water, soil and/ or enzymes are called non-biodegradable pollutants. These are very serious pollutants.

Substances such as metallic oxides : Particulates of mercury, lead, arsenic etc., insecticides, pesticides, DDT etc. are non-biodegradable pollutants.

(iv) **Biodegradable Pollutants :** These include the pollutants that can be rapidly decomposed by natural or by some artificial systems. Decomposition is naturally caused by micro-organisms. Examples of biodegradable pollutants are paper, cloth, wood, domestic sewage, faecal matter and agricultural residues.

How does a pollutant differ from a contaminant?

A contaminant is a substance which does not occur in nature, but is introduced in significant amounts into the environment by human activities. It may or may not be harmful to the living organisms and the environment. A contaminant which is harmful falls under the category of pollutant.

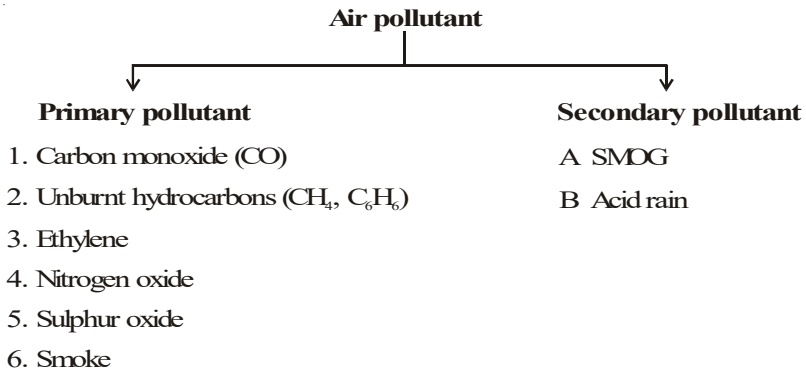
One well-known example of a contaminant is that of Pyrosulphuric acid ($H_2S_4O_7$) that had leaked from a defective tank in Delhi, leading to the death of many persons and causing skin and breathing problems to many others. As pyrosulphuric acid does not occur in the atmosphere, it is a contaminant. Further, as it had dangerous effects, it is also a pollutant.

Threshold Limit Value (TLV) : The permissible limit of a pollutant in the atmosphere to which if a healthy worker is exposed for eight hours a day or 40 hours a week throughout his life and there is no adverse effect on him is called Threshold Limit Value (TLV). For example, TLV of carbon monoxide is 40 p.pm, while that of carbon dioxide is 5000 p.pm. On the other hand, for a poisonous gas like phosgene, TLC is 0.1 p.pm.

AIR POLLUTION

Degradation of air quality and natural atmospheric conditions constitutes air pollution.

Air pollutants can be classified into two categories.



Some days related to environment
World environment day = 5th June
National pollution prevention day = 2nd December
Hiroshima day = 6th August
Nagasaki day = 9th August
Ozone day = 16th September

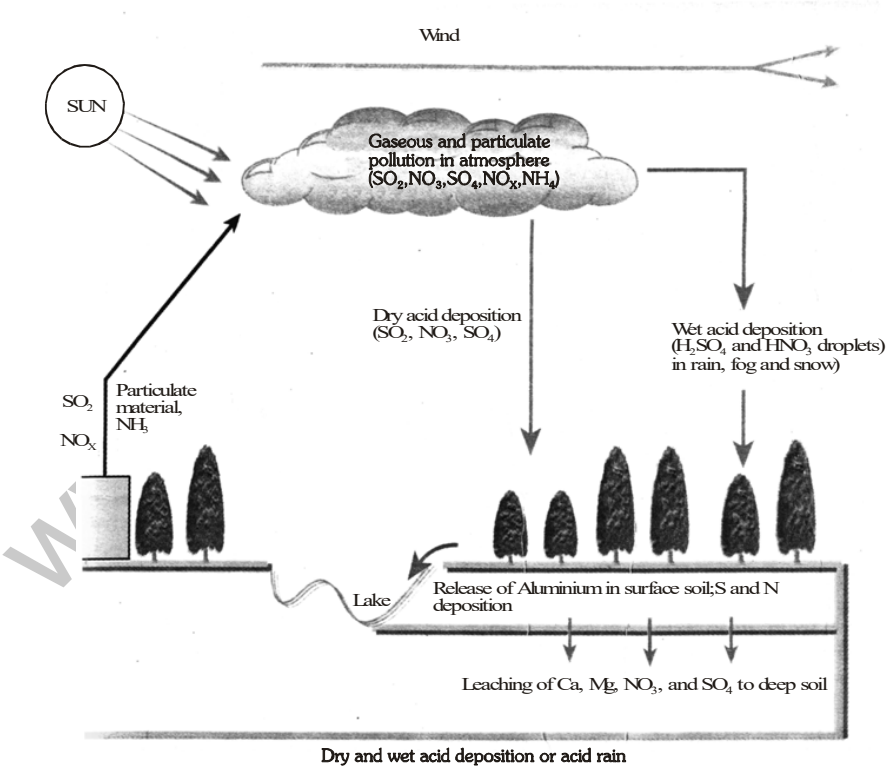
Check your grasp

1. Define air pollution.
2. Name any two secondary pollutants.
3. Differentiate between pure air and polluted air.
4. What are major constituents of air?

Acid rain : This word was given by Robert Augus, NO_2 and SO_2 (Nitrogen dioxide and Sulphur dioxide) released from different sources in form of smoke dissolved in atmospheric water vapour to form sulphuric acid and nitric acid (H_2SO_4, HNO_3). These acids came down on earth with rain water called acid rain.

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$$

$$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$$



Dry and wet acid deposition or acid rain

Effects of acid rain :-

1. Due to acid rain acidity of soil increases and fertility of soil decreases.
2. Acid rain corrodes metals, marble, painted surface, leather, fabrics etc.
3. Spots and corrosion of marble due to acid rain is known as **stone leprosy**.

Effect of air pollution on the historical building like Tajmahal

THE TAJMAHAL

The industries located in and around Agra like rubber processing automobiles, chemical and especially Mathura Oil Refinery have been responsible for producing pollutants like sulphur dioxide and nitrogen dioxide. These gases react with water vapour in the atmosphere to form sulphuric acid and nitric acid. The acid drop down with rain making the rain acidic.

Acid rain corrodes the marble of monument, this process is known as **Marble Cancer**. Suspended particulate matter such as soot particles emitted from Mathura Oil Refinery has contributed towards the yellowing of marble.

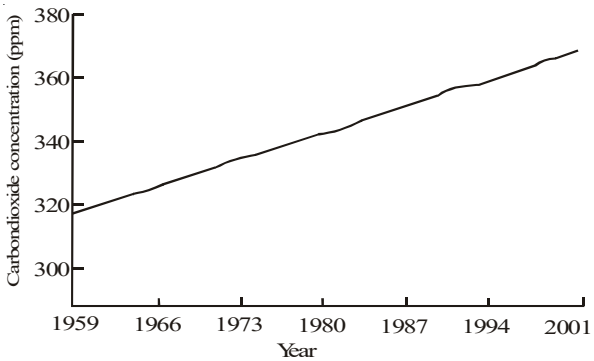
- Supreme court has ordered industries to switch to cleaner fuel like CNG and LPG.
- CNG – Compressed natural gas.
- LPG – Liquefied petroleum gas.
- Use of unleaded petrol vehicle or battery operated vehicle in Taj zone.

Q. What kind of danger does the Tajmahal face from pollution?

GREEN HOUSE EFFECT

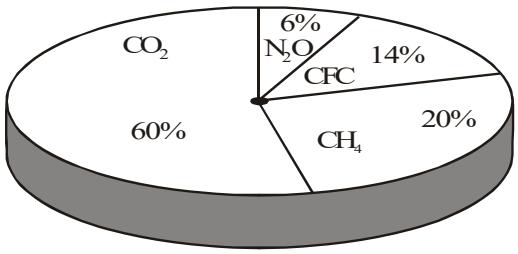
Green house effect was predicted by Fourier (1827) and term was coined by Arrhenius

Usually carbon dioxide is not considered as pollutant but its higher concentration forms thick layer above the earth's surface. Checks the radiation of heat from the earth surface because of this temperature of earth surface increases, this is called **Green house effect** or Global Warming.



The increase in mean carbon dioxide concentration in the atmosphere

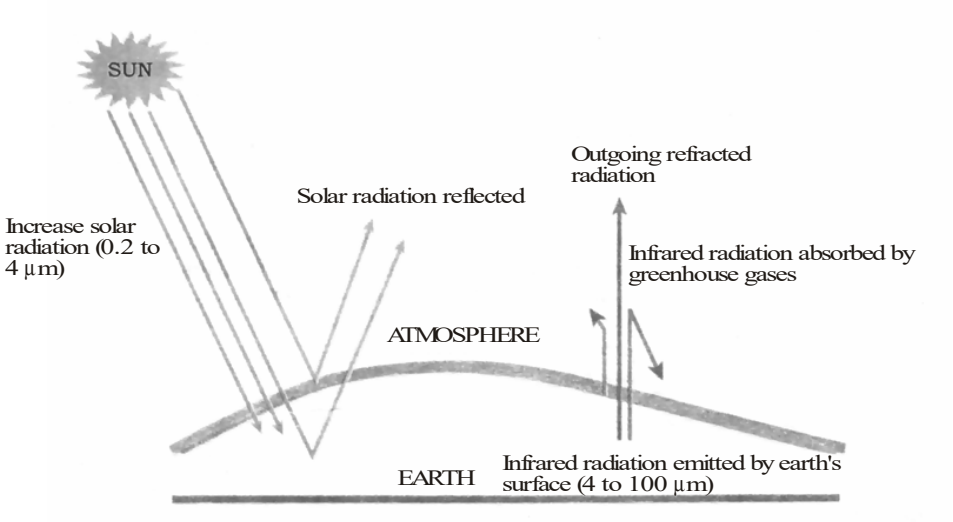
Main green house gases are CO_2, CH_4, CFC, N_2O released from various industries and agriculture units which are responsible for green house effect.



Relative contribution of different green house gases

In this phenomenon cover of CO_2 layer around the earth allow the short wave length incoming solar radiation to come in but does not allow the long wave length of out going heat radiation from warm surface of earth and keep the earth warm.

The consequent increase in global mean temperature is referred as Global warming.



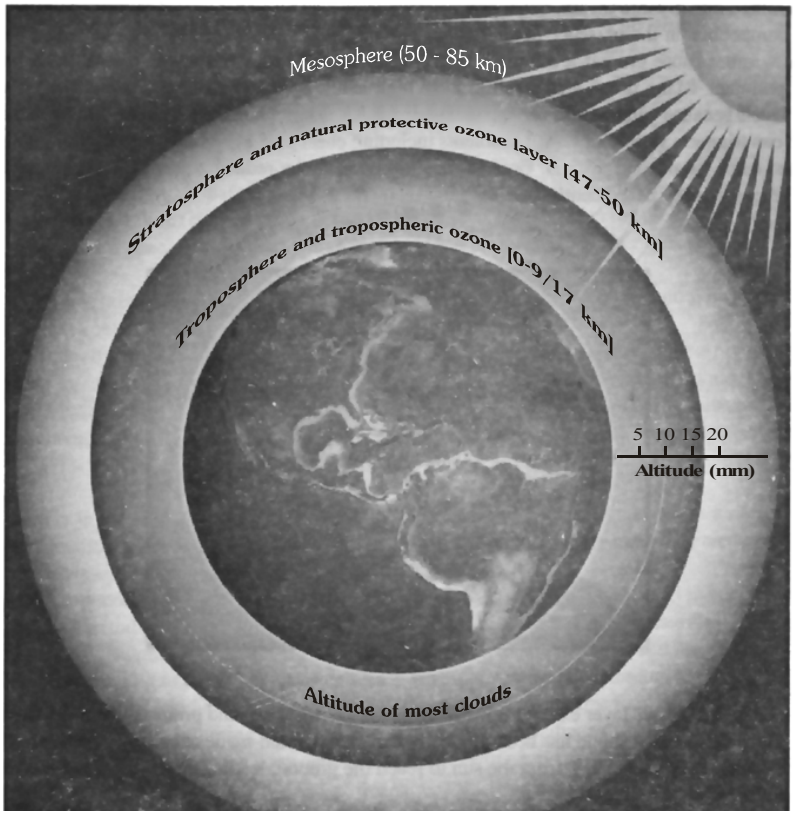
Approaches to deal with Global warming

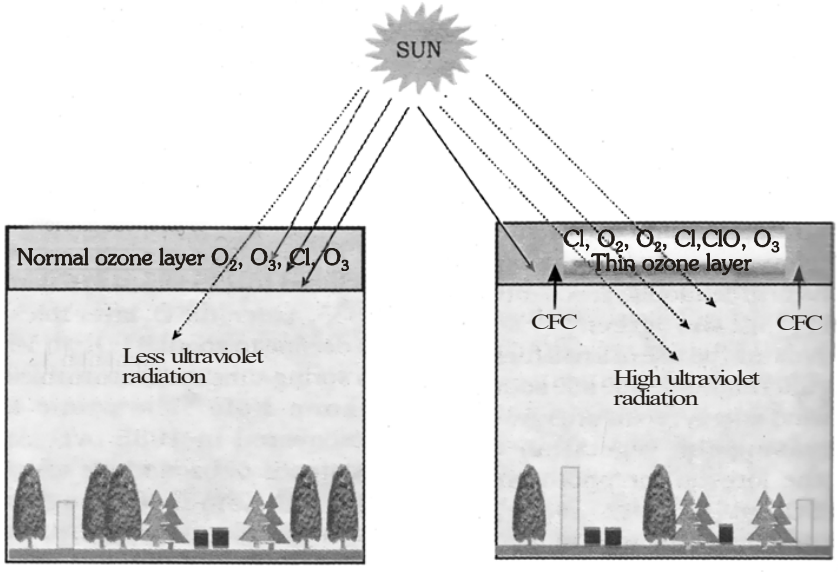
Reducing the green house gas emissions by limiting the use of fossil fuel and by developing alternative renewable sources of energy. Like : Wind energy, solar energy.

- Increasing the vegetation cover particularly the forest for photosynthetic utilization of CO_2
- Minimizing the use of nitrogen fertilizers in agriculture for reducing N_2O emissions.
- Developing substitutes for chlorofluorocarbons.

OZONE DEPLETION

CFC's (also called freons) are responsible for the destruction of the ozone layer in the atmosphere. The ozone layer protects both plants and animals life on earth by absorbing the harmful ultraviolet radiation of the sun.





The ozone depletion process begins when CFCs and other ozone-depleting substances (ODS) are emitted into the atmosphere, strong UV light breaks apart the ODS molecule into atoms. It is these atoms that actually destroy ozone, not the intact ODS molecule.

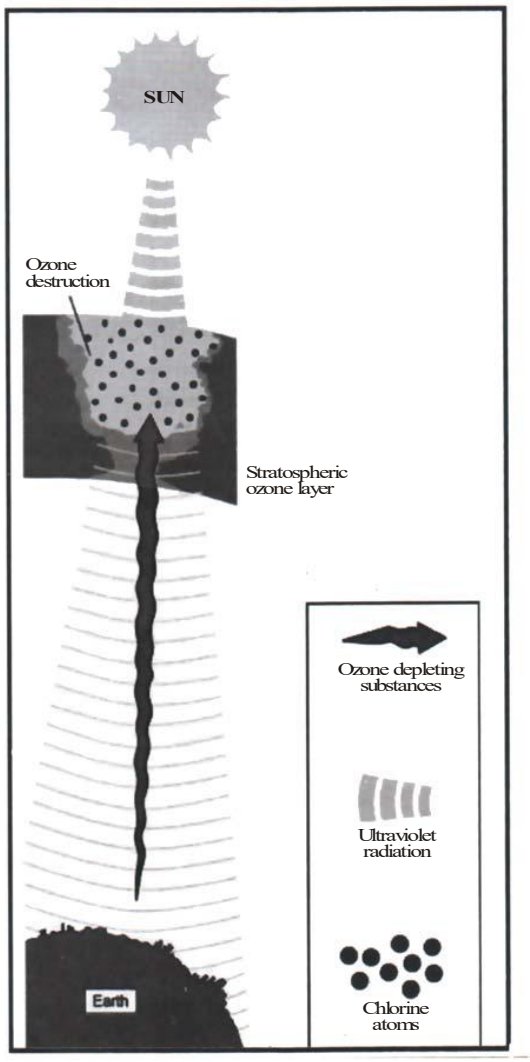
It is estimated that one chlorine atom can destroy over 10,0000 ozone molecules before it is removed from stratosphere.

Effects : (i) Incidence of cataract, skin cancer, photo burning.

(ii) A large number of land animals becomes blind.

(iii) Damage to nucleic acids will increase resulting in higher number of mutations.

(iv) U.V. radiations inhibits photosynthesis by affecting photosynthetic machinery.



Q. Name two Green house gases.

Q. What is meant by Green house effect?

Q. How is acid rain formed? Discuss its ill effects.

Q. Write one main protective function of ozone layer.

Do you know?

Waldsterben :- Decline of forest and trees due to acid rain first noticed in late **1970 s in Germany**.

Delhi :- Delhi is the 4th most polluted city of the world where about 7500 deaths occur annually due to air pollution.

Tokyo :- The most polluted city, a traffic policeman requires two hours of oxygen treatment after duty to ward off effect of air pollution.

Ozone Depletors :- Montreal protocol (1987) identified eight chemicals as ozone depletors and Viena convention for protection of ozone layer (1992) identified a total of 19 ozone depletors.

Prevention of air pollution :

- Use of unleaded petrol should be encouraged, Arrester and scrubbers should be used to separate particulate matters from contaminated air.
- Engines should not be kept started when vehicle is in rest condition, catalytic converter should be used in motor vehicles.
- It is also very essential to check the quality of gases released from the factories .
- Industries should not be established at one place.
- The smoke should be released into the atmosphere after purification and filtration.
- To separate particles larger than 50 µm gravity setting tanks or porous filters are being used.

Electrostatic precipitator

Some more to know :

- **Green Belt :-** It is an area left out for growth of vegetation. It is important in cities and towns for reduction in level of CO_2, release of O_2, moderation of weather condition providing aesthetic pleasure and open space for residents.
- **Green Muffler :-** Growth of green plants along road sides to reduce noise pollution.
- **Silent spring :-** Novel written by **Rachel Carson 1962** mentioning the effect of DDT on birds DDT use has been banned in U.S.A. since then DDT banned for agriculture use in India in 1985.

  DDT is non degradable pollutant
- **Neeri –** National environmental engineering research institute is at **Nagpur**

INTERNATIONAL INITIATIVE FOR MITIGATING GLOBAL CHANGE

Montreal protocol :- (16 September 1987) 27 industrialized countries agreed to limit production of chlorofluorocarbons to half the level of 1986.

Helsinki declaration :- May 1989 Montreal protocol was ratified by 82 nations at Helsinki, They pledged to phase out CFCs by 2000.

Earth summit :- (United nations conference on environment and development 1992). It was held in RiO-de-Janeiro (Brazil) and adopted the recommendations of CCC *(Convention on climate change)* for reducing green house gases. The recommendations was signed by 154 nations. They pledged to maintain emission of green house gases at 1990 level.

Kyoto protocol :- (December 1997) International conference held in Kyoto, Japan obtained commitment from different countries for reducing overall green house gas emission at a level 5% below 1990 level by 2008-2012.

WATER POLLUTION

The water pollution is caused by the addition of organic and inorganic chemicals as well as the biological, radiological materials which change the physical and chemical properties of water. This harmful process is called water pollution.

Water pollutants mainly belong to three categories –

Biological :- Various pathogens **Ex –** Viruses, bacteria, protozoa, helminthes, algae.

Chemical :- Organic wastes, organic biocides **Ex –** DDT, BHC, PCBs, inorganic chemicals like As, Pb, Cd, Ni, Hg, phosphates, nitrates, fluoride etc.

Physical :- Hot water, Oilspills.

D.D.T.	–	Dichloro, Diphenyl trichloro ethane
B.H.C.	–	Benzene hexa chloride.
P.C.B.s.	–	Poly chlorinated biphenyls
As	–	Arsenic
Pb	–	Lead
Cd	–	Cadmium
Ni	–	Nickel
Hg	–	Mercury.

Sources of water pollution :- There are two types of sources of water pollution:

Point Source	Non point source
Factories, power plants, underground coal mines and oil wells situated close to water surface. They discharge pollutants directly into water source.	Non point source are scattered and do not have any specific location for discharging pollutants into particular water body. These include runoff from. Fields, lawns, garden.

EFFECT OF WATER POLLUTION

Algal Bloom :- Availability of excess nutrients cause profuse growth of algae (algal bloom) especially the blue green algae. Such algal bloom may totally cover the water surface and often release toxin in water and some time cause deficiency of oxygen in water. Aquatic animals may die due to toxicity and lack of oxygen.

Eutrophication :- The process of nutrient enrichment of water and consequent loss of species diversity is called eutrophication.

Lichen , Tubifex and some insects larvae like chironomus are called pollution indicators.

Lichens are most sensitive to SO_2 pollution.

Q. Define water pollution.

Q. Write a short note on algal bloom.

Q. Name any one bioindicator of pollution.

Q. Write full form of D.D.T.

Enrich your knowledge

- **Dew point :-** Temperature at which air becomes saturated with water vapour. Below this temperature water vapours of air form droplets, larger ones forming dew and smaller ones forms fog or mist.

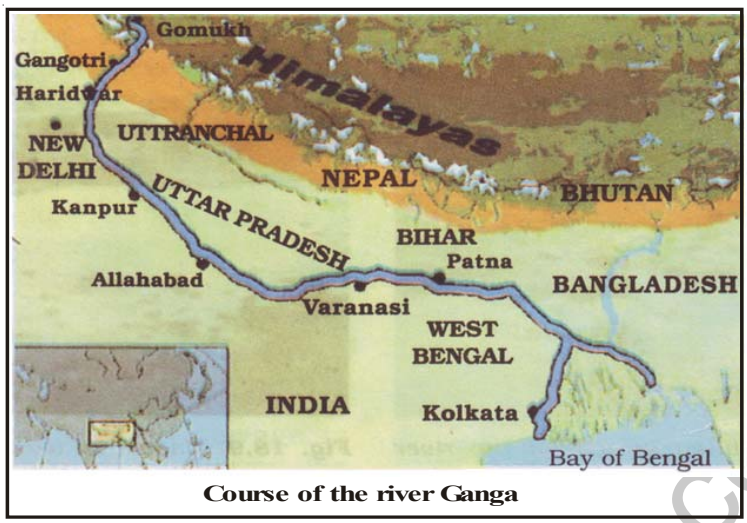
- **Agent orange :-** The name of weed killer used in Vietnam by U.S. forces. It was named so because of orange stripe on its packing.

  Agent orange consisted of equal parts of 2,4-D and 2, 4, 5, -T with dioxin as a contaminant. It has caused cancer in handlers and deformilites in their children.

- **Polonium 210 :-** Automobile exhausts have this radioactive carcinogen probably as companion of antiknock lead added to gasoline.

  Unleaded petrol has been introduced in India with effect from first April 1995.

POLLUTION OF GANGA



Course of the river Ganga

Ganga or Bhagirathi rises from Gangotri Glacier in Garhwal Himalayas.

Ganga is one of the most famous river of India. However recently a study by world wide fund for nature (WWF) found that Ganga is one of the ten most endangered rivers in the world. The towns and cities through which the Ganga river flow throw large quantities of garbage, untreated sewage, dead bodies and factories discharge. This makes river dead means aquatic life cannot survive in it.

An ambitious Ganga action plane was launched in 1985. It aimed to reduce pollution level in river. Kanpur the most populated and industrial city of Agra has one of the most polluted stretches of the river Ganga. Throwing of garbage and other non biodegradable thing to river and many industries like fertilizer, detergent leather and paint industries directly pour their discharge into the river this activity make the water dead.

Do You Know ?

In Gangatic water a bacteria *Bdellovibrio bacteriovorus* is found, it kill the another water pollutant bacteria.

CONTROL MEASURES OF WATER POLLUTION

The industrial and municipal waste waters should be treated before discharging them into drains.

District legislation should be enacted to make it essential for the industries to treat the effluents before being discharged into rivers and seas.

- Toxic industrial wastes from the factories should be properly treated to remove the harmful substances present in it. Only the treated waste should be discharged into water.

- Sewage from the cities should be treated at the sewage treatment plant to remove all suspended impurities and organic matter before discharging it into water.
- Excessive use of fertilizers and pesticides should be discouraged. Instead, biological fertilizers and pesticides (biodegradable) should be used.
- Proper toilet facilities should be provided to the rural people.
- The use of synthetic detergents should be minimized. If possible, use biodegradable detergents.
- Industrial wastes should be recycled.
- Trees and plants must be planted along the banks of rivers.
- We should not wash clothes, clean utensils and take bath near a source of water.
- Wells should be covered.
- Garbage should not be thrown into rivers/lakes.
- Educating the public about the dangers of pollution.
- Enactment of laws to punish the offenders.

Water (Prevention and control of pollution) Act 1974 – use of ecofriendly fertilizers and herbicides should be encouraged to prevent water pollution.

We should follow reduce, reuse and recycle rule.

Thermal pollution can be reduced by employing techniques such as use of cooling towers, spray ponds. So as to cool the water before discharging into water bodies.

Q. What main factors are responsible for pollution of Ganga?

Q. Name the most industrialised city situated at bank of river Ganga.

TRAGEDIES OF POLLUTION

- **Bhopal gas disaster :–** December 3, 1984 Methyl isocyanate (MIC) leaked out from pesticide unit of union carbide. It killed over 2000 and injured over 250, 000 persons.
- **Chernobyl :–** (Ukraine April 1986). Reactor burst due to over heating causing leakage of radioactive substance.
- **Gulf war 1990 :–** Fire from oil wells changed colour of clouds and rain in north India.
- **Gangotri Glacier :–** Between 1842-1935 Gangotri glacier was receding at the rate of 7.3 m/year while between 1935-1990 the rate was 18m/year. The current rate of retreat is 30 m/year.

Disease	Pollutant
Minimata/ Minamata	First reported in 1952, Minamata bay of Japan-due to mercury poisoning
Methaemaglobinanacmia or blue baby syndrome	Excess nitrate in drinking water
Black foot disease	Chronic exposure of arsenic causes black foot disease, diarrhoea, hyper keratosis, hyperpigmentation
Fluorosis	Excess fluoride in drinking water
Itai-itai (ouch-ouch)	Cadmium poisoning (first reported in Toyoma city of Japan)

Q. What is full form of SPM? What does it consist of ?

Q. Define industrial effluent.

CONSERVATION OF WATER

Water can be conserved by the following methods:

(a) **By maintaining the water cycle :** The water cycle can be maintained in perfect form in the following ways:

- Conserve forests
- Plant more trees
- Construct check-dams to prevent flow of rain water into rivers and finally to sea.
- Adopt water-harvesting techniques to replenish the ground water.
- Save water. Use modern methods of irrigation, such as sprinklers, drip irrigation method, etc.
- Construct dams and reservoirs to control floods and use this conserved water for irrigation during dry season.

(b) **By preventing water pollution :** Water pollution can be prevented by disposing sewage and industrial wastes into rivers/lakes only after proper treatment.

POTABLE WATER

Water is essential for plants and animals. The water consumed by human beings and animals should be free of impurities.

Water free from harmful materials that can have adverse effects on the health of human beings and animals is known as potable water.

In other words, water fit for human consumption is potable water.

Drinking water should be colourless and odourless. It should also be free from :-

- Any suspended impurities.
- Any harmful germs.
- Large quantity of salts.
- Any harmful salt such as nitrates, urea, cyanides, etc.

So, water without any chemical, biological and physical impurities or contaminants and which contains enough oxygen in it is fit for consumption.

The dissolved oxygen in water is designated as **DO. DO** content below 8.0 mg/ℓ may be considered unfit. Higher the number of microbes in water, lower is the dissolved oxygen **(DO)**.

The measure of oxygen required by aerobic decomposers for the biochemical degradation of biodegradable organic materials in water is called **Biochemical Oxygen Demand (BOD)**. Higher the **BOD**, lower would be the **DO**.

Chemical Oxygen Demand (COD) is another measure of pollution. It is the measure of oxygen equivalent of the requirement for degradation of total organic matter (Biodegradable and Nonbiodegradable) present in water.

Hence, potable water should have high DO and low BOD & COD, along with absence of inorganic and physical pollutants. Unfortunately, such water is becoming scarce in the world today.

PURIFICATION OF DRINKING WATER

Water should be purified before usage to remove suspended impurities and to destroy harmful germs.

(a) **Water treatment for city supply :** Water from natural sources contain many impurities. To make it fit for drinking, these impurities must be removed. The method used for purifying water depends upon the source of water. People in big cities get purified river or lake water through a network of water pipelines.

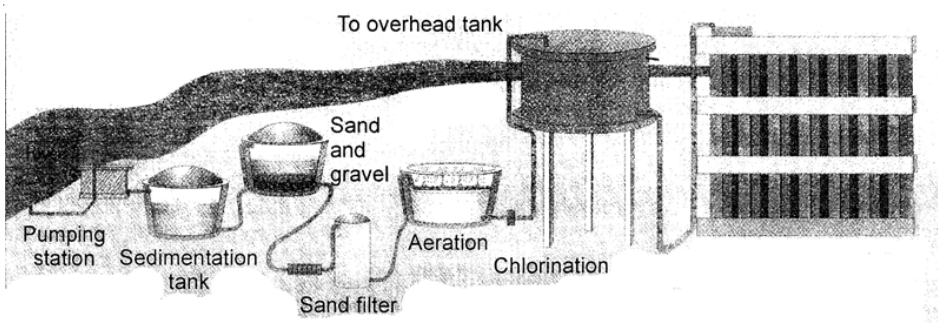
(i) **Removal of suspended impurities :** Water is pumped from a river or a lake into a large tank. Here, it is mixed with a small quantity of alum and allowed to stand for some time. The suspended particles of clay etc., settle down slowly at the bottom of the tank. The upper layer of water is then sent for filtration.

(ii) **Filtration :** The water after sedimentation is filtered through thick layers of sand and gravel. Here, the fine suspended impurities get removed.

(iii) **Aeration :** Air under pressure is then blown into the filtered water. This process called aeration, kills harmful microorganisms present in the filtered water.

(iv) **Chlorination :** The filtered and aerated water is chlorinated by adding chlorine to it. Chlorine kills all harmful germs. Thus, chlorination of water is done to make it free from all harmful microorganisms.

The purified and chlorinated water is supplied to the users through a network of water-pipes.



Various steps involved in the purification of river/lake water for drinking purpose

(b) **Purification of water at home :** In villages and small towns, public water supply is not available. People in such places get their water from wells, handpumps, springs or from rivers and lakes. Water from these sources may not be fit for drinking and cooking.

Small quantity of such water can be made fit for drinking and cooking as described below :

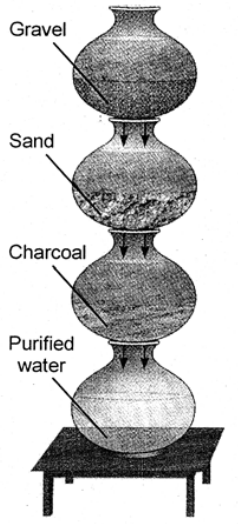
(i) **By filtration :** Any suspended impurities in the water from well, river or lake can be removed by filtering water through a fine muslin cloth.

(ii) **By boiling :** The filtered water can be made germfree by boiling for 10-15 minutes and cooling it before use.

(iv) **By treating with some chemicals :** The filtered water can also be made germfree by adding a small quantity of any of the chemicals, such as, potassium permanganate, bleaching powder or chlorine tablets.

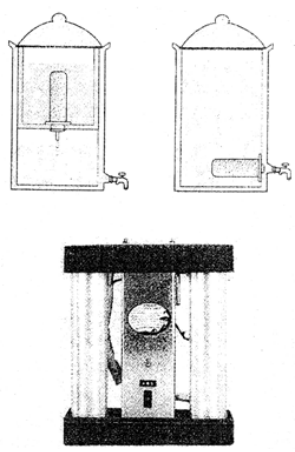
(vi) **By exposing water to ultraviolet radiation :** The filtered water can also be made germfree by exposing it to ultraviolet radiation. Now-a-days, many water-purifiers available in market are based on this method. At domestic level, water can be purified by filtering it through the layers of gravel, sand and charcoal and boiling it before use.

(c) **Domestic water filters and purifiers :** Special water filters/purifiers are now-a-days used in schools, offices, and homes to purify water. The simplest form of domestic water filter consists of a porous pot made of clay/ceramic. This porous pot acts as a filter and removes all suspended impurities from the water. This filter must be cleaned periodically or replaced after a long use.



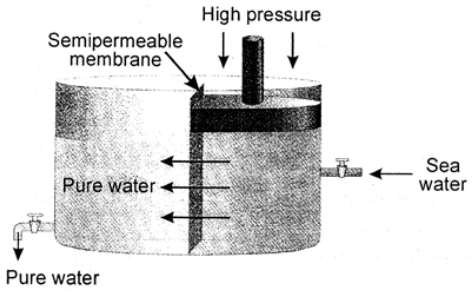
Traditional sand filtering technique for water purification at domestic level

Water purifiers, apart from removing suspended impurities also remove harmful salts (by ion exchange resins) and kill harmful microorganisms (by ultraviolet radiation). Such purified water is once again filtered through microfilters before delivering for drinking.



Some domestic water purifiers

Water purification by reverse osmosis is also used for purifying water for domestic use. In this method, sea water (or saline water containing high salt content) is taken in a tank fitted with a semipermeable membrane. A high pressure is applied on the sea water. Pure water passes through the membrane to the other side and can be used.



Desalination of sea water by reverse osmosis

SOIL POLLUTION

Industrial effluents, domestic sewage, garbage, wastes, polythenes, cans, and many more day-to-day waste materials, when dumped on the land, make it infertile. This is because of the presence of harmful chemicals which do not let plants grow. This is called soil pollution.

Addition of harmful substances to the land that deteriorate its quality is called soil pollution. The major soil pollutants are different types of biocides used in agricultural practices, fertilizers, industrial wastes such as chemicals, fly ash, garbage, discarded food, paper, plastics, rubbers, cloth, leather, metals, carcasses, etc.

NOISE POLLUTION

Noise is defined as sound without value or any sound that is undesirable by the recipient. In other words, noise is a wrong sound, in the wrong place, at the wrong time.

Noise pollution, thus, refers to the unwanted sound dumped into the atmosphere leading to health hazards. Noise is a physical form of pollution and has no persistent effects on the life-supporting systems, but it has direct effects on the recipients.

The unit of noise is decibels (dB). Any value greater than 80 dB causes noise pollution.

CONSERVATION MOVEMENTS

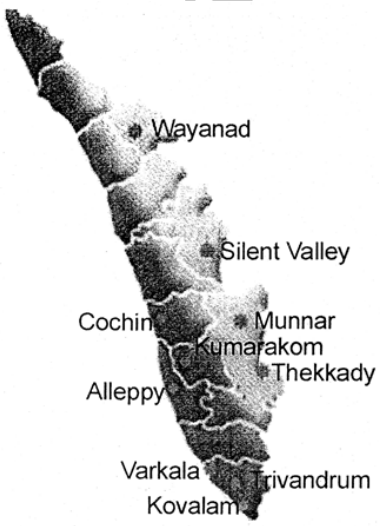
In India, there has been a concerted effort to spread awareness on the conservation of natural resources, especially forests and water. A few of them are listed below :

1. **Narmada Bachao Andolan :** Initiated under the leadership of the popular environmentalist, Mrs. Medha Patkar, Narmada BachaoAndolan was formed with an aim to protect the trees and people that would get destroyed by the proposed construction and rise in the height of various dams on river Narmada. The Sardar Sarovar dam project across river Narmada alone would submerge nearly half a million hectares of forests and agricultural land.

3. **The Chipko Movement :** This refers to a public movement in 1970s and 1980s against the destruction of forests. The noted environmentalist and social worker, Sundarlal Bahuguna of Tehri village led the movement from front alongwith Chandi Prasad Bhatt of Gopeshwar village played an important role in the success of the movement. A large number of villagers assembled and hugged the trees when contractors tried to cut those trees. The incident happened in the village, 'Mandal' in Uttar Pradesh, in 1973. This movement spread to various other districts of Uttar Pradesh in the next few years.

5. **Protest at Plachimada (Kerala) :** It is the recent example of general awareness of conservation of natural resources. A soft drink factory which derived ground water for their use, had to be temporarily closed down when the villagers realized that the valuable ground water is getting exhausted and the water table was drastically going down. This protest became a popular movement and the working of the factory still remains suspended.

7. **Silent Valley Protest :** The Western Ghats, extending through Kerala attracted the attention of environmentalists world wide, when authorities decided to construct a dam in Silent Valley, a virgin forest area in the Malabar area of Kerala. Silent Valley is believed to be a store house of various unknown flora and fauna. Students, educationists, media and the villagers called for a wide protest against the construction of the dam which would have destroyed valuable natural resources of our country. The protest was so intense that the Indian government abandoned the idea of construction of dam.



Map Showing Silent Valley

WORLD ENVIRONMENT DAY AND ENVIRONMENT CLUBS

To spread awareness among common man, the United Nations Organization decided to celebrate June 5 as the World Environment Day. In educational institutions, environment clubs are formed and on the World Environment Day, activists take part in various activities that include slide shows, talks, planting saplings, clean the environment programme and various competitions and quiz programmes. The 'Green Olympiad', a popular competition based on environmental issues is conducted for the students all over India.

QUICK REVISION

- Water pollution is the contamination of water by unwanted and harmful substances such as sewage, toxic chemical and industrial wastes.
- Excessive growth of algae in the waterbodies is called eutrophication.
- Major causes of water pollution are the discharge of industrial toxic wastes and untreated sewage into the river.
- Accumulation of harmful chemicals in the body of living organisms is called bioconcentration.
- Potable water is one which is suitable for drinking.
- Potable water should be colourless, odourless and free from suspended impurities, chemicals and germs.
- Water can be made fit for drinking at home, either by boiling or by using chlorine tables. Candle water filters or modern water purifiers can also be used.
- City water can be purified by sedimentation, filtration and chlorination processes.
- Cholera, typhoid, dysentery and diarrhoea are water-borne diseases.
- Pollution is induction of certain unwanted substances in air, water and land, which cause undesirable changes in properties of the air, water and land.
- A pollutant need not be harmful in itself, but in high concentrations it has harmful effects.
- Acid rain occurs when sulphur dioxide and nitrogen oxides from the burning of fossil fuels combine with water vapour in the atmosphere.
- Water pollution is the induction of objectionable matter in water that changes its properties and makes it unfit for various purposes.
- Air is a mixture of many gases, present in a fixed ratio. When the ratio is disturbed for any reason, the air is said to be polluted.
- The runoff containing chemicals and other materials used on watershed agricultural lands contributes to chemical contamination of water.
- The contamination of soil may be due to the discharge from industrial sites or leaking underground storage tanks is also a cause of pollution.
- Concentrations of nitrate in water have carcinogenic effects, which may lead to Blue Baby Syndrome, Met haemoglobin anaemia and hampering oxygen transport in blood.
- Eutrophication is the gradual increase in the concentration of phosphorus, nitrogen and other plant nutrients in an aquatic ecosystem.
- Sufficient good quality of water to be severd as drinking water is termed potable water.

IMPORTANT POINTS

- Air pollution : Contamination of air with harmful gases, dust, smoke, etc.
- Pollutant : Any harmful substance which causes pollution.
- S P M : Suspended particulate matter in the air.
- Acid rain : Rain water mixed with pollutants like oxides of sulphur and nitrogen.
- Water pollution : Contamination of water with harmful toxic substances.
- Eutrophication : Excessive growth of algae in waterbodies.
- Bioconcentration : Accumulationof harmful pesticides in the body of living organisms.
- Sedimentation : The process of settling down of suspended impurities as sediments in water.
- Chlorination : Process of adding chlorine in water to kill harmful germs.
- Potable water : Water which is fit for drinking.
- Adsorption : Absorption from surface.
- Algal bloom : Excessive growth of algae in a water body due to contamination.
- Fluorosis : Disease caused due to consumption of fluoride rich water.
- Indoor pollution : Pollution due to indoor air.
- Non-point source : The diffuse discharges whose location cannot be identified.
- Point Sources : Readily identified single location of causing pollution.

FOR SUMMATIVE ASSESSMENT

1. Where was the painful bone disease Itai-itai reported first –

(A) Britain (B) India (C) Japan (D) USA

2. Which one of the following is not a green house gas –

(A) CO_2 (B) CH_4 (C) O_2 (D) CFCs

3. Montreal protocol was signed in –

(A) 1978 (B) 1987 (C) 1991 (D) 1993

4. Photo chemical smog was first observed in –

(A) Los Angeles (B) Tokyo (C) Newyork (D) Sydney

5. Acid rain is due to –

(A) Water pollution (B) Air pollution (C) Automobile pollution (D) Pesticide pollution

6. Maximum air pollution is at –

(A) Delhi (B) Bhopal (C) Kolkata (D) Bangalore

7. Waldsterben is –

(A) Decline in forest (B) Development of fog

(C) Harm to sculptures, statues and building (D) All of the above

8. In air pollution Delhi ranks –

(A) First most polluted (B) Second most polluted (C) Third most polluted (D) Fourth most polluted

9. The term green house effect was given by –

(A) Fourier (B) Tyndall (C) Arrhenius (D) Linnaeus

10. The term 'acid rain' was given by –

(A) Fourier (B) Augus (C) Tyndall (D) Linnaeus

11. Chlorination of treated waste water is required for –

(A) Killing all microbes (B) Removing suspended materials

(C) Complete breakdown of organic matter (D) All of the above

12. Black foot disease in humans is caused by –

(A) Arsenic (B) SPM (C) Fluorine (D) Cadmium

13. Ozone depletion shall cause higher incidence of –

(A) Skin cancers (B) Cataract (C) Decreased immunity (D) All of the above

14. Eutrophication of water body occur due to addition of

(A) Detergents (B) Fertilisers (C) Sewage (D) All of the above

15. Minamata disease is due to pollution of

(A) Organic waste into drinking water (B) Oil spill in water

(C) Industrial waste mercury into fishing water (D) Arsenic into the atmosphere

FILL IN THE BLANKS

1. The most important _____ source of air pollution is volcanic activity.
2. Due to the fast spread of industrialisation and advancement of technology, ____ has become a universal problem.
3. Filtration allows any _____ matter to be mechanically or physically removed from water.
4. Staining of teeth is an indication of _____
5. Air pollution affects humans directly, causing _____ irritation or _____

MARK 'T' IF THE STATEMENT IS TRUE AND 'F' IF IT IS FALSE

1. Irrigation water contains dissolved salt.
2. The micro-organisms present in water bodies play no role in natural cleaning of water.
3. The cost of purifying polluted water for community use is generally quite low.
4. Some of the common point sources of contaminants are fertilisers, farmyard manure and compost.
5. The microbiological filter candle is an effective way of preventing transmittable disease transmitted through drinking water.
6. In reverse osmosis, a permeable membrane filter separates the water from contaminants.
7. Boiling is used to disinfect water infected with micro-organisms.
8. In Rajasthan, groundwater contains very high levels of lead and iron.

MATCH THE FOLLOWING

1. Match the substances given in column A with their uses given in column B.

Column-A		Column-B	
(1)	Non-point	(i)	Rajasthan
(2)	Fluorosis	(ii)	Water pollution
(3)	Air pollution	(iii)	Kills harmful microbes
(4)	Smoking	(iv)	Adsorption
(5)	Industrial effluents	(v)	Monument
(6)	Ultraviolet radiation	(vi)	Small scale filtration
(7)	Carbon filtration	(vii)	Nitrate concentration
(8)	Acid rain	(viii)	Indoor pollution
(9)	Cloth filters	(ix)	Caughing
(10)	Methemoglobin anaemia	(x)	Farmyard manure and compost

VERY SHORT ANSWER TYPE QUESTIONS

1. Name the process of filtering in which a semi-permeable membrane separates the water from contaminants.
2. What is absorbed by the earth's ozone layer?
3. Which disease is caused by water containing fluoride?
4. Which is more harmful, indoor or outdoor air pollution?
5. Which type pollution causes irritation of the eyes?
6. What is reverse osmosis?
7. Which chemical leads to Blue Baby Syndrome?
8. What happens when too much nutrients flow into a lake?
9. How does 'carbon filtration' actually work?
10. The presence of which metal delays normal physical and mental development?

SHORT ANSWER TYPE QUESTIONS

1. Define 'Eutrophication'?
2. How effective is reverse osmosis as a water filtration method?
3. How is radiactive pollution harmful to us?
4. What causes acid rain?
5. What types of pollutants are given off by forest fires?
6. When do you call a substance a pollutant?
7. According to you, what is potable water?
8. Differentiate between filtration of water on a small scale and on a larger scale.
9. What is 'good quality water'?
10. What are the major causes of nitrate pollution of water?

LONG ANSWER TYPE QUESTIONS

1. Discuss the supply of water in urban areas.
2. Explain how indoor pollution takes place. In what ways is it harmful?
3. Why is depletion of the earth's ozone layer such a serious issue?
4. What is fluorosis? How does it affect people? In which parts of our country it is mainly found?
5. How does biological contamination of water happen?
6. Explain how fertilisers lead to contamination of water.
7. How does contaminated water affect human beings?
8. If water is apparently crystal clear, does that mean it is pure? Discuss.
9. What are the various activities of human beings that make the air impure?
10. Discuss what the government is doing to reduce pollution.

FIND THE ODD ONE OUT

1. Forest fire, grass fires, pollen grains, water pollution.
2. Air pollution, industry effluents, excreta, solid waste.
3. Non-point source, industries, municipal sewage treatment plants, septic tanks.
4. Point source, farmyard manure, NPK, compost.
5. Fever, mottled teeth, pitted teeth and hypoplasia.

POLLUTION — **ANSWER KEY** — EXERCISE-1

For Summative Assessment

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	C	B	A	B	A	A	D	C	B	A	A	D	D	C

Fill in the blanks

1. Point **2.** Pollution **3.** Particulate **4.** Fluorosis **5.** Allergy, Asthama

True/False

1. T **2.** F **3.** F **4.** F **5.** T **6.** F **7.** T **8.** F

Match the column

1. (1) → (x), (2) → (i), (3) → (ix), (4) → (viii), (5) → (ii), (6) → (iii), (7) → (vi), (8) → (v), (9) → (iv), (10) → (vii).

FOR SUMMATIVE ASSESSMENT

1. DDT is –
   (A) Green house gas (B) Degradable pollutant
   (C) Nondegradable pollutant (D) None of these
2. National environmental engineering research institute is at –
   (A) Kanpur (B) Nagpur (C) Delhi (D) Madras
3. The most polluted city of the world is –
   (A) Newyork (B) Tokyo (C) Mexico (D) Kolkata
4. Green house effect is mostly due to –
   (A) H_2 (B) CO (C) CO_2 (D) N_2
5. Unleaded petrol has been introduced in India with effect from –
   (A) First January 1996 (B) First April 1995 (C) First April 1996 (D) First January 1997
6. Pollution indicator is –
   (A) Agrobacterium (B) Lichen (C) Pteridium (D) Both A and B
7. Minamata disease first occurred in –
   (A) Japan (B) Russia (C) China (D) Korea
8. Which of the following gases contributes to global warming –
   (A) Nitrogen dioxide (B) Carbondioxide (C) Carbon monoxide (D) Sulphur dioxide.
9. Eutrophication is a type of –
   (A) Land pollution (B) Air pollution (C) Water pollution (D) Noise pollution
10. Chlorofluoro carbons are air polluting agents. They are produced by –
    (A) Acid batteries (B) Diesel trucks (C) Aerosols (D) jet planes
11. Pollution is controlled by –
    (A) Banning atomic blasts (B) Use of electrically operated automobiles
    (C) Sewage treatment (D) All of the above
12. World environmental day is –
    (A) 5^{th} June (B) 28^{th} February (C) 5^{th} August (D) 28^{th} April
13. Ozone day is –
    (A) January 30 (B) December 25 (C) April 21 (D) September 16
14. Potable water is the one that is –
    (A) Kept in a pot (B) Fit to drink (C) Not fit to drink (D) Used only in laboratory
15. Epidemics such as typhoid and jaundice are caused by –
    (A) Metals (B) Toxic chemical (C) Micro organisms (D) Dissolved salts.

FILL IN THE BLANKS

1. _____ is the addition of harmful substances into the environment.
2. _____ are responsible for the depletion of ozone layer in the atmosphere.
3. _____ combines with our blood and hampers the transport of oxygen within the body.
4. Due to _____ the snow of glaciers at the poles will melt and cause floods.
5. Runoff from agricultural lands results in _____
6. Untreated industrial wastes contain _____ substances that make water unfit drinking.
7. _____ is a water-borne disease.
8. _____ of the air is needed by all living beings, plants and animals, while green plants need _____ as well to prepare their food.

9. If plants are cut down, then the _____ level in the air will go up.
10. _____ are responsible for the depletion of the ozone layer in the atmosphere.
11. Sewage wastes should be treated well to remove _____ substances, before being released into water.
12. More and more _____ plants should be put up, so that water can be used many times and in many ways, before it is disposed off.

MARK 'T' IF THE STATEMENT IS TRUE AND 'F' IF IT IS FALSE

1. Bathing with soap should be allowed near the rivers to control water pollution.
2. Sewage wastes can be directly, disposed off in water bodies.
3. Eutrophication has adverse effects on aquatic ecosystems.
4. Volcanoes and forest fires are natural sources of air pollution.
5. Smog is made up of smoke and carbon dioxide.
6. Only man causes air pollution

MATCH THE COLUMN-A WITH COLUMN-B

1.

Column-A		Column-B	
(1)	Carbon dioxide	(i)	Automobiles
(2)	Yellowing of Taj Mahal	(ii)	Fit for drinking
(3)	Natural source of air pollution	(iii)	1985
(4)	Potable water	(iv)	Global warming
(5)	man made source of air pollution	(v)	Acid rain
(6)	Ganga Action plan	(vi)	Volcanoes

ANSWER THE FOLLOWING QUESTIONS

1. What do you understand by the term pollution ? How does air get polluted ?
2. How are plants affected by air pollution ?
3. How does air pollution affect human beings and other animals ?
4. How can we control air pollution ? List any five measures.
5. How do water bodies get polluted ? List any three causes.
6. How does water pollution affect marine animals ?
7. What steps can we take to control pollution of water bodies ?
8. Discuss the three main processes employed in purification plants to make water fit for drinking.
9. What do you mean by the term potable water ? What are the characteristics of potable water ?
10. If you feel that the water supplied to your home contains germs or microorganisms, what steps can you take to make it fit for drinking ?

POLLUTION — **ANSWER KEY** — EXERCISE-2

For Summative Assessment

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	C	B	B	C	B	B	A	B	C	C	D	A	D	B	C

Fill in the blanks

1. Pollution **2.** CFCs **3.** CO **4.** Global warming **5.** Water pollution **6.** Toxic **7.** Jaundice **8.** O_2, CO_2 **9.** CO_2 **10.** CFCs **11.** Harmful toxic **12.** Treatment.

True/False

1. F **2.** F **3.** T **4.** T **5.** F **6.** F

Match the column

1. (1) → (iv), (2) → (v), (3) → (vi), (4) → (ii), (5) → (i), (6) → (iii)

FOR SUMMATIVE ASSESSMENT

1. Eutrophication is caused due to the presence of excessive :

(A) Nitrates in water (B) Phosphates in water

(C) Both (A) & (B) (D) None of these

2. The accumulation of harmful pesticides in the living body is known as :

(A) Eutrophication (B) Bio-concentration

(C) None (D) Both (A) & (B)

3. Ganga Action plan deals with :

(A) Cleaning Ganga (B) Purify water

(C) Supplying water (D) All

4. Greenhouse effect is causes due to excessive release of :

(A) Methane (B) Carbon dioxide

(C) Both (A) & (B) (D) None of these

5. Acid rain damages :

(A) Old monuments (B) Old statues (C) Both (A) & (B) (D) None of these

6. The major causes of air pollution include :

(A) Burning of coal and petroleum

(B) Afforestation

(C) use of catalytic converters in automobiles

(D) Recycling of paper

7. Pollution affects :

(A) Plants, animals and human beings (B) Plants only

(C) Animals and plants (D) Human beings only

8. Air pollution causes :

(A) Global warming (B) Floods (C) Acid rain (D) All of these

9. Water pollution is mainly caused by :

(A) Wastes being dumped in water bodies without treatment

(B) Chlorofluorocarbons

(C) Vehicular fumes

(D) Global warming

10. Water pollution leads to :

(A) Eutrophication (B) Leaching (C) Soil erosion (D) Acid rain

11. Which of the following is not a green house gas?

(A) Nitrogen (B) Methane

(C) Sulphur dioxide (D) Hydrogen

12. Which gas mainly causes global warming?

(A) Nitrogen (B) Methane (C) Carbon dioxide (D) Hydrogen

13. Ganga Action plan was launched in :

(A) 1999 (B) 2001 (C) 1985 (D) 1977

14. Ganga is most polluted at :

(A) Varanasi (B) Kanpur (C) Allahabad (D) Rishikesh

FILL IN THE BLANKS

1. Hydrogen sulphide _____ silver objects.
2. Greenhouse effect is produced due to increase in _____
3. Acid rains damage old _____ and old _____
4. Luxuriant growth of algae in a water body is called _____
5. _____ is a greenhouse gas.

MARK 'T' IF THE STATEMENT IS TRUE AND 'F' IF IT IS FALSE

1. Water pollution is hazardous to all forms of life.
2. Pure drinking water has a distinct taste.
3. Sulphur dioxide gas eats up limestone and marble of buildings.
4. Acid rains are harmful for aquatic life.
5. Bioconcentration is useful for living organisms.

MATCH THE COLUMN-A WITH COLUMN-B

1.

Column-A		Column-B	
(1)	Bioconcentration	(i)	Purify water
(2)	Eutrophication	(ii)	Sulphur dioxide
(3)	Greenhouse effect	(iii)	Pesticides
(4)	Acid rain	(iv)	Carbon dioxide
(5)	Chlorine	(v)	Fertilisers
		(vi)	Hydrogen sulphide

VERY SHORT ANSWER TYPE QUESTIONS

1. Which gases are emitted from auto-exhaust?
2. Which is the major source of air pollution in metro cities?
3. Why should sewage not be dumped into the rivers?
4. What is potable water?
5. What are greenhouse gases?

SHORT ANSWER TYPE QUESTIONS

1. Define the terms : pollution and pollutant.
2. List four sources of water pollution.
3. What is greenhouse effect?
4. State two harmful effects of air pollution
5. What is bioconcentration of pesticides?

6. How Taj Mahal's beauty is in danger.
7. What is the cause of global warming?
8. Name the ways due to which water gets contaminated.
9. Why and how the increased levels of nutrients affect the survival of aquatic organisms?
10. What is chemical contamination of water? How is it caused?

LONG ANSWER TYPE QUESTIONS

1. Discuss how we can reduce air pollution.
2. What is acid rain? How is it caused? What are its ill effects?
3. Describe the Green house effect.
4. Write a short note on air and water pollution.
5. Clear transparent water is always good for drinking, comment on this statement.
6. Discuss how we can reduce air and water pollution.
7. What is the difference between pure and polluted air?
8. What is green house effect?
9. What is smog?
10. What are the different ways in which water gets contaminated?
11. Name the plan launched to clean the river Ganga.
12. Name the air pollutant which is harmful to the ozone layer.
13. Write four methods to prevent water pollution.
14. Describe methods to purify water supplied to our houses.
15. What are the harmful effects of water pollution?
16. What is global warming?
17. What are the limitations of purification of water using sunlight?
18. Deforestation results in the degradation of three most important components of the environment air, water and soil. How?

POLLUTION — **ANSWER KEY** — EXERCISE-3

For Summative Assessment

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ans.	C	B	A	C	C	A	A	D	A	A	D	C	C	B

Fill in the blanks

1. Corrodes **2.** CO_2 **3.** Monuments, statues **4.** Eutrophication/Algal bloom **5.** CO_2

True/False

1. T **2.** T **3.** T **4.** T **5.** F

Match the column

1. (1) → (iii), (2) → (v), (3) → (iv), (4) → (ii), (5) → (i)