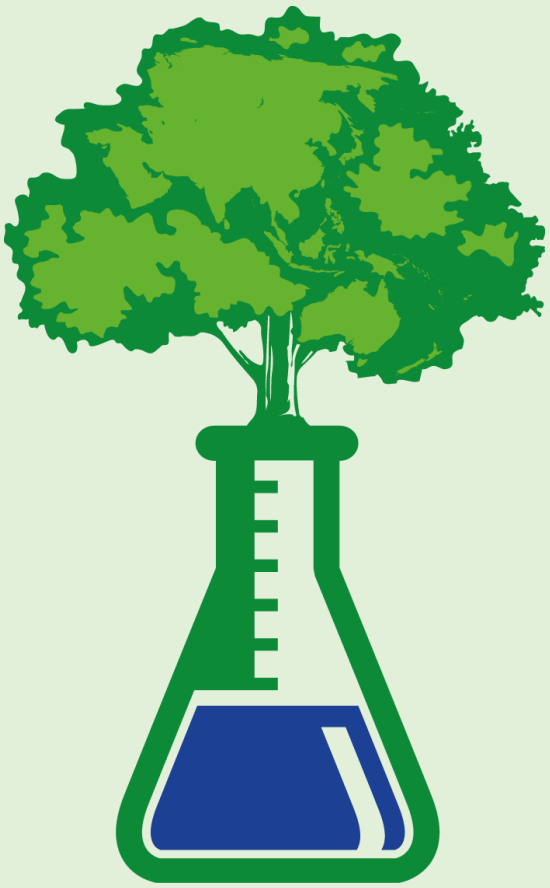
# 14. ENVIRONMENTAL CHEMISTRY



Chemistry Smart Booklet

Theory + NCERT MCQs + Topic Wise Practice MCQs + NEET PYQs

# Environmental Chemistry

It is a way of thinking and utilizing the existing knowledge and principles of chemistry and other science to reduce the adverse impact in environment.

**Green chemistry**

Gradual increase in average temperature of surface of the earth due to increase in concentration of green house gases ($CO_2$, $CFC_s$, $CH_4$)

**Global warming**

**Green House Effect**

It is naturally occurring phenomenon responsible for heating earth's surface and atmosphere

**Biochemical oxygen demand (BOD)**

Amount of oxygen required by bacteria to break down the organic matter present in a certain volume of a sample of water.

**Water Pollution**

**Pathogens**

Organic waste chemical pollutants Plastic waste.

**Soil Pollution**

- Pesticides
- Herbicides
- Industrial waste
- Plastics

**Preventions**

- Use of manures.
- Use of bio-fertilizers.
- Proper Sewage System.
- Salvage and recycling.

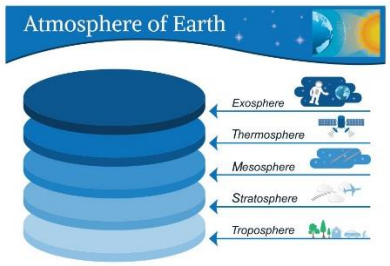
**Types**

1. Biodegradable waste: Generated by cotton mills, paper mills, textiles, etc.
2. Non-biodegradable waste: Generated by power plants, Steel plants, fertilizer industries.etc

**Atmosphere**

**Layer of Atmosphere**

| | |
|---|---|
| Troposphere : | 0-10 km |
| Stratosphere : | 10-30 km |
| Mesosphere : | 30-50 km |
| Thermosphere : | 50-400 km |
| Exosphere : | 400 km |




**Atmospheric pollution**


When pH of rain water drops below 5.6

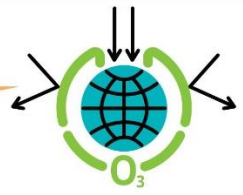
**Acid Rain**

Oxides of Sulphur
Oxides of Nitrogen
Oxides of Carbon → Co, $Co_2$
Particulate pollutants
Hydrocarbons

**Smog → Smoke + Fog**

- Classical Smog
- Photochemical Smog

**Depletion of $O_3$ Layer**




**OZONE DEPLETION**

Chlorofluorocarbon (CFC's)
CFC + hV (high heat) + $O_3$
↓
Free Cl ion
Free Cl ion + $O_3$ → $O_2$ + O

# ENVIRONMENTAL CHEMISTRY

## Introduction

Interrelation of biological, social, economical, physical and chemical studies with our surrounding is called environmental studies. Environmental pollution is the greatest health hazard all over the world. Environmental chemistry deals with the study of the origin, transport, reactions, effects and fates of chemical species in the environment.

An undesirable change in physical, chemical or biological characteristics of air, water and land that is harmful to human life and other living organisms, living conditions, cultural assets, industrial progress and harms our resources is called pollution.

## Environmental Pollution

Undesirable changes that have harmful effects on plants, animals and human beings in our surrounding is called environmental pollution.

**Pollutant**

The substance which causes pollution and is harmful for environment is called pollutant. Pollutants are of two types:

1. **Biodegradable**

   Those substances which are degraded rapidly by natural process or artificial methods are called biodegradable pollutants. Ex- discarded vegetables.

2. **Non-biodegradable**

   Those substances which degrade at very slow rate or does not degrade by natural biological process, for example, DDT, arsenic salts of heavy metals, radioactive materials and plastics are non-biodegradable pollutants.

## Atmospheric Pollution

Lowest layer of atmosphere is troposphere which have dust, water vapour and clouds, it contains dust, water vapour and clouds while stratosphere contains ozone. Atmospheric pollution includes both troposphere and stratosphere pollution.

### Tropospheric Pollution

Tropospheric pollution occurs due to the presence of undesirable solid or gaseous particles in the air.

## 1. Gaseous air pollutants:

i. **Oxides of Sulphur:** Oxides of sulphur are produced when sulphur containing fossil fuel is burnt. The most common species, sulphur dioxide, is a gas that is poisonous to both animals and plants. It has been reported that even a low concentration of sulphur dioxide causes respiratory diseases e.g., asthma, bronchitis, emphysema in human beings. Sulphur dioxide causes irritation to the eyes, resulting in tears and redness.

$2SO_2 + O_2 \longrightarrow 2SO_3$

ii. **Oxides of Nitrogen:** Mainly produced by combustion of fossil fuels at high temperature in automobile engines mainly NO and $NO_2$.

These produce reddish brown haze or brown air $NO_2$ is more dangerous than NO. These oxides can cause pulmonary oedema, dilation of arteries, eye irritation, heart problems, injury to liver and kidneys and also causes acid rains.

$N_2 + O_2 \longrightarrow 2NO$

$2NO + O_2 \longrightarrow 2NO_2$

iii. **Hydrocarbons**: Produced naturally (e.g., marsh gas) as well as due to incomplete combustion. These are carcinogenic and causes irritation of mucous membrane, eyes. They causes ageing, breakdown of tissues, shedding of flower, leaves and twigs in plants.

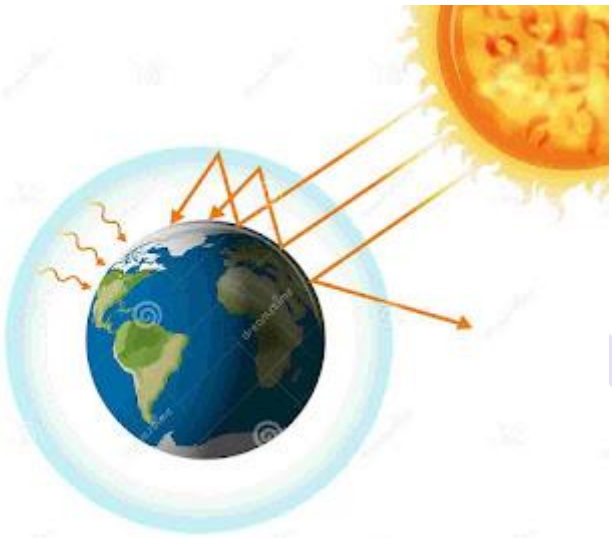
iv. **Carbon monoxide:** It is colourless, odourless gas. It is produced by incomplete combustion of fuels, naturally it is produced by oceans or by decaying of organic matter by bacteria. It is poisonous because it combines with hemoglobin to form 300 more times stable carboxyhemoglobin which reduces oxygen-carrying capacity of blood and results into giddiness, headache, decreased vision, cardiovascular malfunction and asphyxia. Cigarette smoke also contains a lot of CO which induces premature birth deformed babies and spontaneous abortions in pregnant women.

v. **Carbon dioxide:** It is produced naturally by volcanic eruptions, respiration. It is also produced by burning of fossil fuels. Increased level of $CO_2$ is controlled by green plants during photosynthesis. It is a greenhouse gas and responsible for global warming. It causes headache nausea and asphyxiation.

## 2. Greenhouse Effect

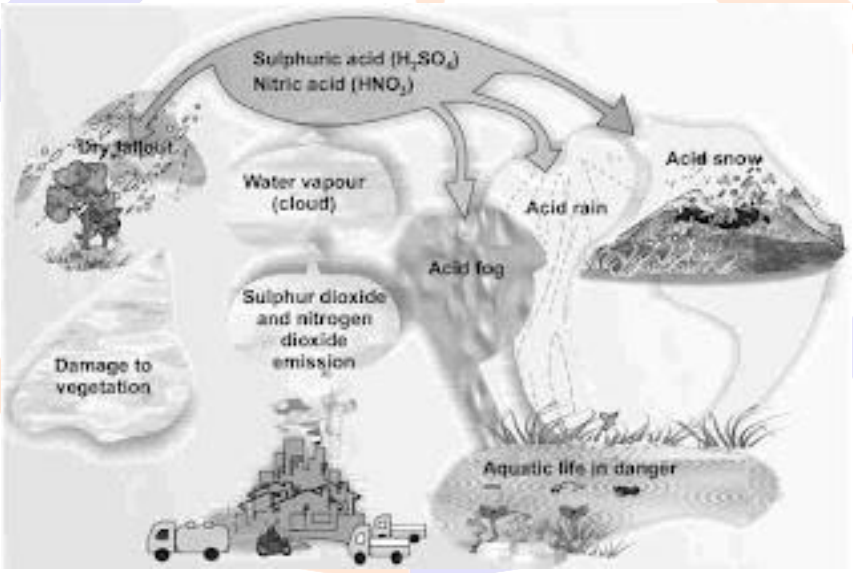
This effect was discovered by Fourier and the term was coined by Arrhenius. 75% of solar radiation is absorbed by earth surface and remaining is reflected back. Some of which is absorbed by greenhouse gases such as carbon dioxide, methane, ozone, chlorofluorocarbon compounds (CFCs) and water vapour in

the atmosphere which increases temperature of atmosphere is called greenhouse effect.



### 3. Acid Rain

When the pH value of the rain water drops below 5.6, it is known as acid rain. Acid rain is a byproduct of a variety of human activities that emit the oxides of sulphur and nitrogen in the atmosphere.




$2SO_2(g) + O_2(g) + 2H_2O(l) \longrightarrow 2H_2SO_4(aq)$

## Stratospheric Pollution

### 1. Ozone Hole

Depletion in the concentration of ozone over a restricted area as over Antarctica is called ozone hole. Stratospheric clouds are formed over Antarctica.

Molecular oxygen splits into free oxygen atoms by UV radiations which combine with molecular oxygen to form ozone.

$O_2(g) \longrightarrow [O](g) + [O](g)$

$[O](g) + O_2(g) \longrightarrow O_3(g)$

As ozone is thermodynamically unstable hence, there exists dynamic equilibrium between its decomposition and formation. Ultraviolet radiations dissociate chlorofluorocarbon to give chlorine-free radical, which combines with ozone to form chlorine monoxide radical which combines with free oxygen to form more chlorine-free radicals.

$CF_2Cl_2 \longrightarrow [C]F_2Cl + [Cl]$

$[Cl] + O_3 \longrightarrow Cl[O] + O_2$

$2Cl[O] + O_3 \longrightarrow 2[Cl] + 2O_2$

**Effects of Depletion of The Ozone Layer:**

Bad ozone is formed in troposphere that harms plants and animals while good ozone is formed in stratosphere which acts as shield. UV rays can enter in earth's atmosphere.

- It is harmful as can cause skin cancer.
- It increases transpiration hence decreases soil moisture.
- It damages paints and fibres, causing them to fade faster.

## Water Pollution

Any unwanted change which detiorate quality of water and make it unfit for drinking is called water pollution. Pollution of water originates from human activities.

### Causes of Water Pollution

1. Organic matter such as leaves, grass, trash etc. as well as excessive phytoplankton growth in water causes water pollution as this matter is decomposed through microbial activity is known as putrescibility which requires oxygen. Degree of impurity of water due to organic matter is measured in terms of Biochemical Oxygen Demand (BOD).

2. **Pathogens:** Disease-causing agents are called pathogens e.g., viruses, bacteria, protozoa, helminthes, algae etc. Human excreta contains E.coli and Streptococcus faecalis bacteria which cause gastrointestinal diseases.

3. **Chemical pollutants:** These are of two types, inorganic and organic.

4. Inorganic pollutants constitute acids, salts, heavy metals such as Cd, Hg, Ni etc. Heavy metals can damage central nervous system, liver and kidneys.

5. Organic pollutants constitute, pesticides, petroleum pollutants, PCBs, detergents, fertilizers etc. PCBs (Polychlorinated Biphenyls) are carcinogenic and phosphatic fertilizers increase algae growth. Acidic water is harmful for aquatic life as well as for drinking.

## Soil Pollution

It is unfavourable alteration of soil by addition or removal of substances and factors which decrease soil productivity, quality of plants and ground water is called soil pollution. Mainly caused by chemicals added into soil as pesticides, herbicides and fertilizers for better productivity.

### Causes of Soil Pollution

1. **Pesticides:** These are actually synthetic toxic chemicals with ecological repercussions. These are used in killing pathogens, pests and in inhibiting unwanted growth in agriculture, horticulture, forestry and water.

2. **Fertilizers:** Excessive use of fertilizers decreases natural microflora hence detiorate soil. Therefore, now a days organic farming is encouraged which involves organic pesticides, biofertilizers and disease resistant varieties.

3. **Industrial wastes:** These are both solid and liquid and are dumped over the soil. These contain toxic chemicals like mercury, copper, zinc, lead, cadmium, cyanides, acid, alkalies etc.

## Strategies to Control Environmental Pollution

Two sources of environment pollutant are household waste and industrial waste. Following method can be used to control them.

1. **Recycling:** Waste are recycled into manufacturing of new material. For example, scrap iron, broken glass, clothes can be made from recycled plastic waste and soon becomes available in market. We can also recover energy from burning combustible waste.

2. **Digestion:** Waste material can be degraded by anaerobic micro-organisms in absence of air. It can be used to produce electricity. First biodegradable and non-biodegradable waste are separated then biodegradable wastes are mixed with water and cultured by bacterial species which produce methane.

3. **Dumping:** Sewage sludge acts as fertilizer because it contains nitrogen and phosphorus hence, it is dumped in land areas which increases soil fertility.

## Green Chemistry

Green chemistry is a way of thinking and is about utilizing the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment. Utilization of existing knowledge base for reducing the chemical hazards along with the development activities are the foundation of green chemistry.

## Summary-

1. Environmental pollution causes undesirable changes in our surrounding that have harmful effect on plants, animals and human beings.
2. Atmospheric pollution is studied as tropospheric pollution and stratospheric pollution.
3. Smog and global warming take place due to tropospheric pollution.
4. Stratospheric pollution causes depletion of ozone layer.
5. Water pollution is caused by pathogens, organic wastes and chemical pollutants.
6. Soil pollution is caused by insecticides, pesticides and herbicides.
7. Industrial waste is of two type, biodegradable and non-biodegradable.
8. Green chemistry is a way of thinking and is about to utilize the existing knowledge and principles of chemistry and other sciences to reduce the adverse impact on environment.

# NCERT LINE BY LINE QUESTIONS

**(1.)** Sewage sludge does not contain **[NCERT Exemplar, Page: 417]**

(a.) Nitrogen (b.) Phosphorus

(c.) Potassium (d.) All of these.

**(2.)** Match Matrix **[NCERT Exemplar, Page: 408]**

Match the pollutants (I) with effect in (II)

| Column I | Column II |
|---|---|
| (i) Oxides of sulphur | (P) Global warming |
| (ii) Nitrogen dioxide | (Q) Damage to kidney |
| (iii) Carbon dioxide | (R) 'Blue baby' syndrome |
| (iv) Nitrate in the drinking water | (S) Respiratory disease |
| (v) Lead | (T) Red haze in traffic and congested areas |

(a.) i → P ii → Q iii → T iv → R v → S (b.) i → S ii → T iii → R iv → P v → Q

(c.) i → Q ii → P iii → S iv → T v → R (d.) i → S ii → T iii → P iv → R v → Q

**(3.)** Which one of the following statements regarding photochemical smog is not correct? **[NCERT Exemplar, Page: 412]**

(a.) Carbon monoxide does not play any role in photochemical smog formation. (b.) Photochemical smog is an oxidising agent in character.

(c.) Photochemical smog is formed through photochemical reaction involving solar energy. (d.) Photochemical smog does not cause irritation in eyes and throat.

**(4.)** In the lower atmosphere, ozone is formed by the reaction between **[NCERT Exemplar, Page: 413]**

(a.) $O_2$ and CFCs (b.) $NO_2$ and $O_2$

(c.) $O_2$ and NO (d.) All of these.

**(5.)** The layer of atmosphere which extends up to 10 km from sea level is called **[NCERT Exemplar, Page: 407]**

(a.) Troposphere (b.) Ionosphere

(c.) Mesosphere (d.) None of these

**(6.)** Which of the following is a sink of CO? **[NEET-2017]**

(a.) Microorganism present in soil (b.) Plants

(c.) Oceans (d.) None of the above.

**(7.)** Which one of the following is not a common component of photochemical smog? **[NEET-2014, NCERT Exemplar, Page: 412]**

(a.) Ozone (b.) Acrolein

(c.) Peroxyacetyl nitrate (d.) Chlorofluorocarbons

**(8.)** Domestic waste will lead to **[NCERT Exemplar, Page: 417]**

(a.) Biodegradable Pollution (b.) Non-Biodegradable Pollution

(c.) Thermal Pollution of Soil (d.) Air Pollution

**(9.)** Matrix Match**[NCERT Exemplar, Page: 416]**

| Column I (Metals) | Column II (Maximum prescribed concentration ppm or mg $dm^{-3}$) |
|---|---|
| (i) Fe | (P) 0.005 |
| (ii) Cd | (Q) 0.2 |
| (iii) Mn | (R) 5.0 |
| (iv) Zn | (S) 0.05 |

(a.) i → Q ii → P iii → R iv → S (b.) i → Q ii → P iii → S iv → R

(c.) i → P ii → S iii → R iv → Q (d.) i → Q ii → R iii → S iv → P

**(10.)** Sewage water is purified by**[NCERT Exemplar, Page: 415]**

(a.) Aquatic plants (b.) Microorganisms

(c.) Light (d.) Fishes

**(11.)** Which one of the following statements is not correct?**[NCERT Exemplar, Page: 415]**

(a.) Clean water would have a BOD value of 5 ppm.

(b.) Fluoride deficiency in drinking water is harmful. Soluble fluoride is often used to bring its concentration up to 1 ppm.

(c.) When the pH of rainwater is higher than 6.5, it is called acid rain.

(d.) Dissolved oxygen (DO) in cold water can reach a concentration up to 10 ppm.

**(12.)** Lead is**[NCERT Exemplar, Page: 416]**

(a.) Air Pollutant (b.) Noise Pollutant

(c.) Radioactive Pollutant (d.) Water and Soil Pollutant

**(13.)** Which of the following practices will not come under green chemistry?**[NCERT Exemplar, Page: 420]**

(a.) If possible, making use of soap made of vegetable oils instead of using synthetic detergents.

(b.) Using $H_2O_2$ for bleaching purpose instead of using chlorine-based bleaching agents.

(c.) Using bicycle for travelling small distances instead of using petrol/diesel-based vehicles.

(d.) Using plastic cans for storing substances.

**(14.)** Which of the following reaction(s) happen(s) during the formation of $O_3$ layer in Stratosphere? **[NCERT Exemplar, Page: 413]**

(a.) $O_2(g) \xrightarrow{UV} O(g) + O(g)$ (b.) $O_2(g) + O(g) \xrightarrow{UV} O_3(g)$

(c.) $O_3(g) \xrightarrow{UV} O_2(g) + O(g)$ (d.) All of the above.

**(15.)** Excess nitrate in drinking water can cause**[NCERT Exemplar, Page: 416]**

(a.) Methemoglobinemia (b.) Kidney damage

(c.) Liver damage (d.) Laxative effect

**(16.)** Which of the following statements about photochemical smog is wrong?**[QR code, NCERT Exemplar, Page: 412]**

(a.) It has high concentration of oxidising agents. (b.) It has low concentration of oxidising agents.

(c.) It can be controlled by controlling the release of $NO_2$, hydrocarbons, ozone, etc.

(d.) Plantation of some plants like Pinus helps in controlling the photochemical smog.

**(17.)** Spraying of DDT produces pollution of which type? **[NCERT Exemplar, Page: 416]**

(a.) Air

(b.) Air and water

(c.) Air and soil

(d.) Air, water and soil

**(18.)** Soil pollution can result in decreased **[NCERT Exemplar, Page: 416]**

(a.) Soil Productivity

(b.) Quality of Plants

(c.) Purity of ground $H_2O$

(d.) All of these.

**(19.)** For clean water BOD is less than **[NCERT Exemplar, Page: 415]**

(a.) 17 ppm

(b.) 12.5 ppm

(c.) 7 ppm

(d.) 5 ppm

**(20.)** Waste management includes **[NCERT Exemplar, Page: 418]**

(a.) the proper disposal of wastes

(b.) the improper disposal of wastes

(c.) both(a) and (b)

(d.) the oxidation of wastes in open air

**(21.)** Biosphere refers to **[NCERT Exemplar, Page: 406]**

(a.) plants of the world

(b.) special plants

(c.) area occupied by living beings

(d.) plants of a particular area

**(22.)** BOD test is made for measuring **[NCERT Exemplar, Page: 415]**

(a.) Air Pollution

(b.) Water Pollution

(c.) Noise Pollution

(d.) Soil Pollution

**(23.)** 'Reducing potentially hazardous waste through smarter production.' **[NCERT Exemplar, Page: 419]** This represents the great step forward for

(a.) green revolution

(b.) green chemistry

(c.) industrial pollution

(d.) green biotechnology

**(24.)** The major source of BOD in River Ganga is **[NCERT Exemplar, Page: 415]**

(a.) Leaf Litter

(b.) Fishes

(c.) Human Waste

(d.) Aquatic Plants

**(25.)** The quantity of $CO_2$ in atmosphere is **[QR code, NCERT Exemplar, Page: 408]**

(a.) 3.34%

(b.) 6.5%

(c.) 0.034%

(d.) 0.34%

**(26.)** DDT is a **[NCERT Exemplar, Page: 416]**

(a.) a fertilizer

(b.) biodegradable pollutant

(c.) greenhouse gas

(d.) non-biodegradable pollutant

**(27.)** Air pollutants that produce photochemical oxidants include **[QR code, NCERT Exemplar, Page: 407]**

(a.) $CO_2$, CO and $SO_2$

(b.) $N_2O$, NO and $HNO_3$

(c.) $O_2$, $Cl_2$ and $HNO_3$ (d.) $O_3$, $Cl_2$ and $SO_2$

**(28.)** The greenhouse effect is caused by **[QR code, NCERT Exemplar, Page: 409]**

(a.) $CO_2$ (b.) $NO_2$

(c.) NO (d.) CO

**(29.)** BOD measures the amount of **[QR code, NCERT Exemplar, Page: 415]**

I. Inorganic Material in water. II. Organic Material in water. Identify the correct option:

(a.) only I (b.) only II

(c.) Both I and II (d.) Neither I nor II

**(30.)** Chauvin, Grubbs and Schrock won 2005 Nobel Prize for the development of **[NCERT Exemplar, Page: 419]**

(a.) Dumas Method (b.) Kjeldahl's Method

(c.) Metathesis Method (d.) Carius Method

**(31.)** UV radiations from sun cause a reaction that produces **[NCERT Exemplar, Page: 413]**

(a.) Fluorides (b.) CO

(c.) $SO_2$ (d.) $O_3$

**(32.)** Which of the following pesticides was introduced during World War II to control malaria? **[NCERT Exemplar, Page: 416]**

(a.) Nicotine (b.) DDT

(c.) Aldrin (d.) Dieldrin

**(33.)** Which of the following statements is NOT true about classical smog? **[NCERT Exemplar, Page: 411]**

(a.) Its main components are produced by action of sunlight on emissions of automobiles and factories. (b.) Produced in cold and humid climate.

(c.) It contains compounds of reducing nature. (d.) It contains smoke, fog and $SO_2$

**(34.)** $SO_2$ gas is poisonous to **[NCERT Exemplar, Page: 407]**

(a.) Animals (b.) Plants

(c.) Both(a) and (b) (d.) Neither (a) nor (b)

**(35.)** In stratosphere CFCs gets broken down by the action of powerful UV radiations releasing **[NCERT Exemplar, Page: 413]**

(a.) $\cdot \dot{C}H_3$ (b.) $\dot{C}lO$

(c.) $\dot{C}l$ (d.) $\dot{C}FCl_2$

**(36.)** Which causes water pollution? **[NCERT Exemplar, Page: 417]**

(a.) Jet Planes (b.) Herbicides

(c.) Smoke (d.) Combustion of fossils

**(37.)** Highly hazardous wastes are produced by **[NCERT Exemplar, Page: 417]**

I. Domestic sewage II. Manure III. Animal excreta

IV. Pesticides V. Nuclear wastes

Identify the correct option

(a.) I and II (b.) II and III

(c.) IV and V (d.) II and IV

**(38.)** Which of the following statements is wrong?**[NCERT Exemplar, Page: 413]**

(a.) Ozone is not responsible for greenhouse effect. (b.) Ozone can oxidise sulphur dioxide present in atmosphere to $SO_3$

(c.) Ozone hole is thinning of ozone layer present in stratosphere. (d.) Ozone is produced in upper stratosphere by the action of UV rays on oxygen.

**(39.)** Which one of the followingstatement is NOT true? **[NCERT Exemplar, Page: 414]**

(a.) Oxides of S, N and C are most widespread air pollutant. (b.) pH of drinking water should be between 5.5 and 9.5

(c.) Concentration of dissolved oxygen below 6 ppm is good for growth of fish. (d.) Clean water would have a BOD value of less than 5 ppm.

**(40.)** In which of the following regions hydrogen and helium are found? **[NCERT Exemplar, Page: 407]**

(a.) Stratosphere (b.) Mesosphere

(c.) Troposphere (d.) Exosphere

**(41.)** Water pollution is caused by **[NCERT Exemplar, Page: 415]**

(a.) Pesticides (b.) Fly ash

(c.) Auto exhausts (d.) Aeroplanes

**(42.)** What is DDT among the following? **[NCERT Exemplar, Page: 417]**

(a.) Greenhouse gas (b.) Fertilizer

(c.) Biodegradable Pollutant (d.) Non-biodegradable Pollutant

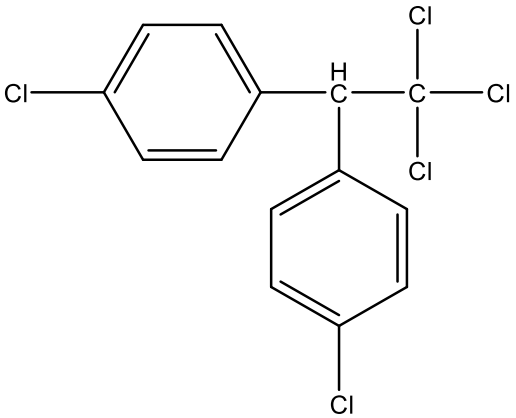
**(43.)** The substance which is not regarded as a pollutant **[NCERT Exemplar, Page: 407]**

(a.) $NO_2$ (b.) $CO_2$

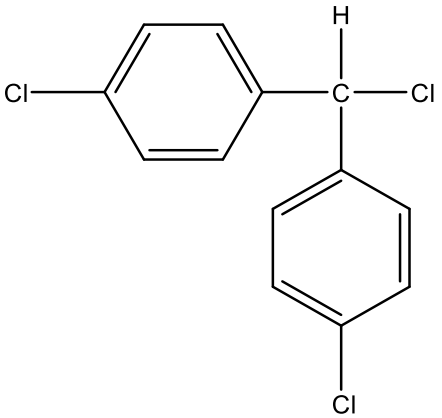
(c.) $O_3$ (d.) Hydrocarbon

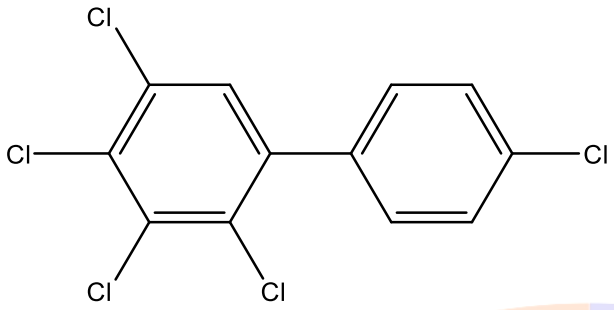
**(44.)** DDT represents: **[NCERT Exemplar, Page: 416]**

(a.)




(b.)



(c.) 


(d.) None of these.

**(45.)** The main element of smog is **[NCERT Exemplar, Page: 411]**

(a.) $O_3$ and PAN (b.) $O_3$

(c.) PAN (d.) PPN and PBN

**(46.)** The greenhouse gas is **[QR code, NCERT Exemplar, Page: 409]**

(a.) $CO_2$ (b.) $SO_2$

(c.) $N_2$ (d.) $H_2S$

**(47.)** Eutrophication causes reduction in **[NCERT Exemplar, Page: 415]**

(a.) dissolved hydrogen (b.) dissolved oxygen

(c.) dissolved salts (d.) All of the above.

**(48.)** How is electricity produced from garbage? **[NCERT Exemplar, Page: 418]**

(a.) Garbage is burnt in open air. (b.) Garbage is cultured with bacteria to produce methane

(c.) Both(a) and (b) (d.) Garbage is put in sea water

**(49.)** The quantity of DDT in food chain **[NCERT Exemplar, Page: 417]**

(a.) decreases (b.) remains same

(c.) increases (d.) changes

**(50.)** Fluoride deficiency in drinking water causes **[NCERT Exemplar, Page: 415]**

I. harmful effect on bone

II. tooth decay

III. blue baby syndrome

Choose the correct option:

(a.) Only I (b.) Only II

(c.) Only III (d.) I and II

# TOPIC WISE PRACTICE QUESTIONS

## TOPIC 1: Air Pollution

**1.** The region containing water vapour is

(1) thermosphere (2) stratosphere (3) troposphere (4) mesosphere

**2.** Main pollutant from automobile exhaust is

(1) CO (2) $CO_2$ (3) NO (4) hydrocarbons

**3.** High concentration of which of the following in atmosphere leads to stiffness of flower buds which eventually fall off from plants?
(1) $NO_2$ (2) $SO_2$ (3) CFC (4) Smog

**4.** Which is related to 'Green House Effect'?
(1) Farming of green plants (2) Farming of vegetables in houses
(3) Global warming (4) Biodegradable pollutant

**5.** The secondary precursors of photochemical smog are
(1) $SO_2$ and $NO_2$. (2) $SO_2$ and hydrocarbons.
(3) $NO_2$ and hydrocarbons. (4) $O_3$ and PAN.

**6.** Which of the following is/are the hazardous pollutant(s) present in automobile exhaust gases?
(i) $N_2$ (ii) CO (iii) $CH_4$ (iv) Oxides of nitrogen
(1) (ii) and (iii) (2) (i) and (ii) (3) (ii) and (iv) (4) (i) and (iii)

**7.** In Antarctica ozone depletion is due to the formation of following compound
(1) acrolein (2) peroxyacetyl nitrate (3) $SO_2$ and $SO_3$ (4) chlorine nitrate

**8.** Formation of London smog takes place in
(1) winter during day time. (2) summer during day time.
(3) summer during morning time. (4) winter during morning time.

**9.** The type of pollution caused by spraying of DDT is
(1) air and soil (2) air and water (3) air (4) air, water and soil

**10.** The gas emitted by supersonic jet planes that slowly depletes the concentration of ozone layer is
(1) CO (2) NO (3) $SO_2$ (4) $O_2$

**11.** The gas responsible for ozone depletion:
(1) NO and freons (2) $SO_2$ (3) $CO_2$ (4) CO

**12.** Which of the following green house gas is released in paddy field?
I. CFCs II. $CH_4$ III. $SO_2$
(1) Only I (2) Only II (3) Only III (4) I and II

**13.** Which gas is responsible for 'Bhopal Gas Tragedy' in 1984?
(1) C O (2) Methyl isocyanate (3) $SO_2$ and $NO_2$ (4) Ethyl isocyanate

**14.** Classical smog occurs in places of
(1) excess $SO_2$ (2) low temperature (3) high temperature (4) excess $NH_3$

**15.** Which is a dangerous radiological pollutant?
(1) $C^{14}$ (2) $S^{35}$ (3) $Sr^{90}$ (4) $P^{32}$

**16.** One free radical of chlorine can destroy molecules of ozone:
(1) 100 (2) 500 (3) 250 (4) 1000

**17.** The smog is essentially caused by the presence of
(1) oxides of sulphur and nitrogen (2) $O_2$ and $N_2$
(3) $O_2$ and $O_3$ (4) $O_3$ and $N_2$

**18.** The non-viable particulate among the following is
(1) dust (2) bacteria (3) moulds (4) fungi

**19.** Which of the following is most abundant hydrocarbon pollutant?
(1) Butane (2) Ethane (3) Methane (4) Propane

**20.** Carbon monoxide (CO) is harmful to man because
(1) it forms carbolic acid. (2) it generates excess $CO_2$.
(3) it is carcinogenic. (4) it competes with $O_2$ for haemoglobin.

**21.** Exposure of an organism to UV system causes
(1) photodynamic action. (2) formation of thymidine.
(3) splitting of H-bonds of DNA. (4) splitting of phosphodiester bonds.

**22.** Which of the following chemical, harmful to ozone, is released by chlorofluoro carbon?
(1) Sulphur dioxide (2) Fluorine free radical (3) Chlorine free radical (4) Nitrogen dioxide

**23.** The biggest particulate matter is
(1) $HNO_3$ droplets (2) soot (3) $H_2SO_4$ droplets (4) fly ash

**24.** The region which is greatly affected by air pollution is
(1) thermosphere (2) stratosphere (3) troposphere (4) mesosphere

**25.** The substance which is not regarded as a pollutant?
(1) $NO_2$ (2) $CO_2$ (3) $O_3$ (4) Hydrocarbons

**26.** Which of the following statement(s) is/are correct ?
(i) Classical smog is a mixture of smoke, fog and sulphur dioxide.
(ii) Classical smog is also called oxidising smog
(iii) Hydrocarbons, $NO_2$ and PAN are components of photochemical smog.
(1) (i) and (iii) (2) (i) and (ii) (3) (iii) only (4) (i), (ii) and (iii)

## TOPIC 2 : Water, Soil Pollution and Green Chemistry

**27.** Sewage water is purified by
(1) aquatic plants (2) micro-oganisms (3) light (4) fishes

**28.** Which pollutant is harmful for 'Tajmahal'?
(1) Hydrogen (2) $O_2$ (3) $SO_2$ (4) Chlorine

**29.** Negative soil pollution is
(1) reduction in soil productivity due to erosion and over use.
(2) reduction in soil productivity due to addition of pesticides and industrial wastes.
(3) converting fertile land into barren land by dumping ash, sludge and garbage.
(4) none of the above.

**30.** The quantity of DDT in food chain
(1) decreases (2) remains same (3) increases (4) changes

**31.** The substance having the largest concentration in acid rain?
(1) $H_2CO_3$ (2) $HNO_3$ (3) HCl (4) $H_2SO_4$

**32.** Water is often treated with chlorine to
(1) remove hardness. (2) increase oxygen content.
(3) kill germs. (4) remove suspended particles.

**33.** Which causes death of fish in water bodies polluted by sewage?
(1) Foul smell (2) Pathogens (3) Herbicides (4) Decrease in D.O.

**34.** Brewery and sugar factory waste alters the quality of a water body by increasing
(1) temperature (2) turbidity (3) pH (4) COD and BOD

**35.** The maximum prescribed concentration of cadmium in drinking water in ppm is
(1) 0.05 (2) 3 (3) 2 (4) 0.005

**36.** The high amount of E. coli in water is the indicator of
(1) hardness of water. (2) industrial pollution.
(3) sewage pollution. (4) presence of chlorine in water.

**37.** A lake with an inflow of domestic sewage rich in organic waste may result in
(1) drying of the lake very soon due to algal bloom.
(2) an increase production of fish due to lot of nutrients.
(3) death of fish due to lack of oxygen.
(4) increased population of aquatic food web organisms.

**38.** Which one of the following statement is **not** true?
(1) pH of drinking water should be between 5.5 – 9.5.
(2) Concentration of DO below 6 ppm is good for the growth of fish.

(3) Clean water would have a BOD value of less than 5 ppm.
(4) Oxides of sulphur, nitrogen and carbon are the most widespread air pollutant.

**39.** The effect of polluted water on soil is, that
(1) it decreases fertility (2) it contaminates ground water
(3) it renders soil acidic or basic (4) all of the above

**40.** Green chemistry means such reactions which :
(1) produce colour during reactions
(2) reduce the use and production of hazardous chemicals
(3) are related to the depletion of ozone layer
(4) study the reactions in plants

**41.** Phosphate pollution is caused by
(1) sewage and agricultural fertilizers. (2) weathering of phosphate rocks only.
(3) agricultural fertilizers only. (4) phosphate rocks and sewage.

**42.** BHC and DDT act as:
(1) Carcinogens (2) Allergens (3) Asthmatic agents (4) All of these

**43.** B.O.D. test is made for measuring
(1) air pollution (2) water pollution (3) noise pollution (4) soil pollution

**44.** Which of the following trophic level has least concentration of toxins deposition ?
(1) Aquatic plant (2) Small fish (3) Human being (4) Largest fish

**45.** What is DDT among the following?
(1) Greenhouse gas (2) A fertilizer
(3) Biodegradable pollutant (4) Non-biodegradable pollutant

**46.** Eutrophication causes reduction in
(1) dissolved oxygen (2) nutrients (3) dissolved salts (4) All of the above

**47.** The agricultural field that produces maximum methane gas into atmosphere is:
(1) Wheat field (2) Paddy field (3) Cotton field (4) Groundnut field

**48.** Disease caused by eating fish found in water contaminated with industrial waste having mercury is:
(1) Minamata disease (2) Bright's disease (3) Hashimoto's disease (4) Osteosclerosis

**49.** Sewage mostly constitutes
(1) Non-biodegradable pollutants (2) Biodegradable pollutants
(3) Effluents (4) Air pollutants

**50.** U.V. radiation from the sun causes a reaction in the atmosphere that leads to production of
(1) Fluorides (2) Carbon monoxide (3) Sulphur dioxide (4) Ozone

## NEET PREVIOUS YEARS QUESTIONS

**1.** Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity? **[2018]**
(1) $N_2O_5$ (2) $NO_2$ (3) NO (4) $N_2O$

**2.** Which of the following is a sink for CO? **[2017]**
(1) Micro organism present in the soil (2) Oceans
(3) Plants (4) Haemoglobin

**3.** Which of the following is not a common component of Photochemical Smog? **[2014]**
(1) Ozone (2) Acrolein (3) Peroxyacetyl nitrate (4) Chlorofluorocarbons

**4.** Among the following, the one that is not a green house gas is :- **[NEET-2019]**
(1) nitrous oxide (2) methane (3) ozone (4) sulphur dioxide

**5.** The liquified gas that is used in dry cleaning along with a suitable detergent is :- **[NEET-2019(ODISSA)]**

(1) Water gas (2) Petroleum gas (3) $NO_2$ (4) $CO_2$

**6.** Which of the following statement is NOT true about acid rain ? **[NEET-2020(COVID)]**

(1) It is due to reaction of $SO_2$, $NO_2$ and $CO_2$with rain water

(2) Causes no damage to monuments like Taj Mahal.

(3) It is harmful for plants.

(4) Its pH is less than 5.6

**7.** Match List - I with List - II. **[NEET-2021]**

| **List -I** | **List-II** |
|---|---|
| a) $2SO_2(g)+O_2(g)\rightarrow 2SO_3(g)$ | i) Acid rain |
| b) $HOCl(g)\xrightarrow{h\nu}\dot{O}H+\dot{C}l$ | ii) Smog |
| c) $CaCO_3+H_2SO_4\rightarrow CsSO_4+H_2O+CO_2$ | iii) Ozone depletion |
| d) $NO_2(g)\xrightarrow{h\nu}NO(g)+O(g)$ | iv) Tropospheric pollution |

Choose the **correct** answer from the options given below.

1) a-ii, b-iii, c-iv, d-i 2) a-iv, b-iii, c-i, d-ii

3) a-iii, b-ii, c-iv, d-i 4) a-i, b-ii, c-iii, d-iv

**8.** The pollution due to oxides of sulphur gets enhanced due to the presence of: **[NEET-2022]**

a) particulate matter

b) ozone

c) hydrocarbons

d) hydrogen peroxide

Choose the most appropriate answer from the options given below:

1) (a),(d) only 2) (a) ,(b),(d) only

3) (b), (c), (d) only 4) (a),(c),(d) only

# NCERT LINE BY LINE QUESTIONS – ANSWERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **(1.)** | c | **(2.)** | d | **(3.)** | d | **(4.)** | b | **(5.)** | a |
| **(6.)** | a | **(7.)** | d | **(8.)** | a | **(9.)** | b | **(10.)** | b |
| **(11.)** | c | **(12.)** | d | **(13.)** | d | **(14.)** | d | **(15.)** | a |
| **(16.)** | b | **(17.)** | d | **(18.)** | d | **(19.)** | d | **(20.)** | a |
| **(21.)** | c | **(22.)** | b | **(23.)** | b | **(24.)** | c | **(25.)** | c |
| **(26.)** | d | **(27.)** | b | **(28.)** | a | **(29.)** | b | **(30.)** | c |
| **(31.)** | d | **(32.)** | b | **(33.)** | a | **(34.)** | c | **(35.)** | c |
| **(36.)** | b | **(37.)** | c | **(38.)** | a | **(39.)** | c | **(40.)** | b |
| **(41.)** | a | **(42.)** | d | **(43.)** | b | **(44.)** | a | **(45.)** | a |
| **(46.)** | a | **(47.)** | b | **(48.)** | b | **(49.)** | c | **(50.)** | b |

# TOPIC WISE PRACTICE QUESTIONS - ANSWERS

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1)** | 3 | **2)** | 2 | **3)** | 2 | **4)** | 3 | **5)** | 4 | **6)** | 3 | **7)** | 1 | **8)** | 4 | **9)** | 4 | **10)** | 2 |
| **11)** | 1 | **12)** | 2 | **13)** | 2 | **14)** | 2 | **15)** | 3 | **16)** | 4 | **17)** | 1 | **18)** | 1 | **19)** | 3 | **20)** | 4 |
| **21)** | 3 | **22)** | 3 | **23)** | 4 | **24)** | 3 | **25)** | 2 | **26)** | 1 | **27)** | 2 | **28)** | 3 | **29)** | 1 | **30)** | 3 |
| **31)** | 4 | **32)** | 3 | **33)** | 4 | **34)** | 4 | **35)** | 4 | **36)** | 3 | **37)** | 3 | **38)** | 2 | **39)** | 4 | **40)** | 2 |
| **41)** | 1 | **42)** | 1 | **43)** | 2 | **44)** | 1 | **45)** | 4 | **46)** | 1 | **47)** | 2 | **48)** | 1 | **49)** | 2 | **50)** | 4 |

# NEET PREVIOUS YEARS QUESTIONS-ANSWERS

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1)** | 1 | **2)** | 1 | **3)** | 4 | **4)** | 4 | **5)** | 4 | **6)** | 2 | **7)** | 2 | **8)** | 2 |

# NCERT LINE BY LINE QUESTIONS – SOLUTIONS

**(1.)** (c) Potassium. Sewage sludge does not contain potassium but it contains some amount of nitrogen and phosphorous.

**(2.)** (d)

| | | | | |
|---|---|---|---|---|
| i → S | ii → T | iii → P | iv → R | v → Q |

**(3.)** (d) Photochemical smog does not cause irritation in eyes and throat.

**(4.)** (b) $NO_2$ and $O_2$

**(5.)** (a) Troposphere.

**(6.)** (a) Microorganisms present in the soil are sink for CO. They remove CO from the atmosphere.

**(7.)** (d) CFCs

**(8.)** (a) Domestic waste will lead to Biodegradable Pollution.

**(9.)** (b)

| | | | |
|---|---|---|---|
| i → Q | ii → P | iii → S | iv → R |

**(10.)** (b) Sewage water is purified by microorganisms.

**(11.)** (c) When the pH of rain water drops below 5.6, it is Acid Rain.

**(12.)** (d) Pb is water and soil pollutant.

**(13.)** (d) Because plastic is non-biodegradable and causing pollution.

**(14.)** (d) All of the above.

**(15.)** (a) Excessive concentration of nitrate in drinking water is harmful and can cause methemoglobinemia (blue baby syndrome) disease.

**(16.)** (b) It has low concentration of oxidising agents.

**(17.)** (d) Air, Water and Soil.

**(18.)** (d) The harmful effect of soil pollution includes decrease in soil productivity, decrease in quality of plants and also decrease in the parity of groundwater.

**(19.)** (d) 5 ppm
$H_2O$ is considered clean when BOD
**(20.)** (a) Waste management includes the proper disposal of wastes.
**(21.)** (c) Area occupied by the living beings.
**(22.)** (b) Strength of sewage or degree of water pollution is measured in terms of BOD.
**(23.)** (b) Green chemistry.
**(24.)** (c) Human wastes are the major source of BOD in River Ganga.
**(25.)** (c) 0.034%.
**(26.)** (d) DDT is a non-biodegradable pollutant.
**(27.)** (b) $N_2O$, NO and $HNO_3$
**(28.)** (a) $CO_2$ causes greenhouse effect.
**(29.)** (b) The amount of BOD in water is a measure of the amount of organic material in H2O, in terms of how much oxygen will be required to break it down biologically.
**(30.)** (c) Metathesis method. Metathesis method in organic chemistry is a way to arrange groups of atom within a molecule that can produce desired molecule of high commercial importance.
**(31.)** (d) $3O_2 \xrightarrow{UV} 2O_3$
**(32.)** (b) During World War II, DDT was found to be of great use in the control of malaria and other insect borne diseases.
**(33.)** (a) Its main components are produced by action of sunlight on emissions of automobiles and factories.
**(34.)** (c) Both(a) and (b), i.e. animals and plants.
**(35.)** (c) $\dot{Cl} \because CF_2Cl_2 \xrightarrow{UV} CF_2\dot{C}l + \dot{C}l$
**(36.)** (b) Herbicides Herbicides are used in fields to kill pests. These leach into the water bodies with rain and cause water pollution.
**(37.)** (c) Highly hazardous wastes are produced by pesticides and nuclear wastes.
**(38.)** (a) Ozone is not responsible for greenhouse effect.
**(39.)** (c) Concentration of dissolved oxygen below 6 ppm is good for growth of fish.
**(40.)** (b) Mesosphere.
**(41.)** (a) Pesticides cause water pollution.
**(42.)** (d) DDT is a non-biodegradable pollutant.
**(43.)** (b) $CO_2$
**(44.)** (a)
**(45.)** (a) $O_3$ and PAN
**(46.)** (a) $CO_2$ is a greenhouse gas.
**(47.)** (b)
**(48.)** (b) Technology developed to produce electricity from the garbage. Garbage is mixed with water and then it is cultured with bacteria for producing methane (biogas). The remaining product is used as manure (compost) and biogas is used to produce electricity.
**(49.)** (c)
**(50.)** (b) tooth decay.

## TOPIC WISE PRACTICE QUESTIONS - SOLUTIONS

**1.** **(3)** Troposphere contains water vapour.
**2.** **(2)**
**3.** **(2)** High concentration of $SO_2$ leads to stiffness of flower buds.
**4.** **(3)**
**5.** **(4)**
**6.** **(3)** CO and oxides of Nitrogen are poisnous gases present in automobile exhaust gases.
**7.** **(1)** In antarctica ozone depletion is due to formation of acrolein.

**8.** **(4)** London smog is formed in morning during winter.
**9.** **(4)** DDT causes air, water and soil pollution.
**10.** **(2)** Nitric oxide (NO) which may be produced at the ground level due to human activity or natural sources or is produced in large amounts in the exhaust gases by the engine of supersonic transport planes and introduced directly into the stratosphere.

$NO + O_3 \longrightarrow NO_2 + O_2$

**11.** **(1)** NO and freons are responsible for ozone depletion.
**12.** **(2)** Large amounts of CH4 are released in paddy fields, coal mines and by fossil fuels.
**13.** **(2)** **14.** **(2)** **15.** **(3)** **16.** **(4)**
**17.** **(1)** Smog is caused by oxides of sulphur and nitrogen.
**18.** **(1)**
**19.** **(3)** Most abundant hydrocarbon pollutant is methane.
**20.** **(4)** CO is highly toxic and impairs respiration. CO combine with haemoglobin of blood and reduces its $O_2$ carry capacity.
**21.** **(3)**
**22.** **(3)** $CF_2Cl_2 \xrightarrow{h\nu} CF_2Cl + \dot{C}l$

$\dot{C}l + O_3 \longrightarrow Cl\dot{O} + O_2$

**23.** **(4)** Fly ash is the biggest particulate matter among the given choices
**24.** **(3)** Air pollution greatly affect the troposphere
**25.** **(2)** CO2 is generally not regarded as pollutant.
**26.** **(1)** Classical smog is also called reducing smog.
**27.** **(2)** Sewage water is purified by micro-organisms.
**28.** **(3)** **29.** **(1)** **30.** **(3)**
**31.** **(4)** Acid rain contains $H_2SO_4 > HNO_3 > HCl$.
**32.** **(3)** Water is often treated with Cl2 to kill germs.
**33.** **(4)** Decrease in D.O causes death of fish.
**34.** **(4)** **35.** **(4)** **36.** **(3)** **37.** **(3)**
**38.** **(2)** The growth of fishes get hindered if the concentration of D.O. is below 6 ppm.
**39.** **(4)**
**40.** **(2)** Green chemistry may be defined as the programme of developing new chemical products and chemical processes or making improvements in the already existing compounds and processes so as to make less harmful to human health and environment. This means the same as to reduce the use and production of hazardous chemicals. i.e. correct answer is option (2).
**41.** **(1)** Phosphate pollution is caused by sewage and agricultural fertilizers.
**42.** **(1)**
**43.** **(2)** Strength of sewage or degree of water pollution is measured in terms of BOD (Biochemical oxygen demand) value.
**44.** **(1)** Lower trophic level has lower toxins deposition than higher trophic level.
**45.** **(4)** DDT is a non-biodegradable pollutant.
**46.** **(1)** Eutrophication causes reduction in D.O
**47.** **(2)** Paddy field
**48.** **(1)**
**49.** **(2)** Domestic sewage constitute biodegradable pollutants.
**50.** **(4)** Ozone

## NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

**1.** **(1)** Nitrous oxide ($N_2O$) occurs naturally in environment. In automobile engine, when fuel is burnt dinitrogen and dioxygen combine to yield NO and $NO_2$.
**2.** **(1)** Microorganisms present in the soil is a sink for CO.
**3.** **(4)** The oxidised hydrocarbons and ozone in presence of humidity cause photochemical smong.

Hydrocarbons + $O_2$, $NO_2$, NO, O, $O_3 \rightarrow$ Peroxides, formaldehyde, peroxyacetyl-nitrate (PAN), acrodein etc. Hence chlorofluoro carbons are not common component of photochemical smog.

**4.** (4)Besides carbon dioxide, other greenhouse gases are methane, water vapour, nitrous oxide, CFCs and ozone.

**5.** (4)$CO_2$

**6.** (2)Acid rain causes to damage to monuments like Tajmahal.

**7.** (2) $2SO_2(g)+O_2(g) \rightarrow 2SO_3(g)$ iv) Tropospheric pollution

$HOCl(g) \xrightarrow{h\nu} \dot{O}H + \dot{C}l$ iii) Ozone depletion

$CaCO_3 + H_2SO_4 \rightarrow CsSO_4 + H_2O + CO_2$ i) Acid rain

$NO_2(g) \xrightarrow{h\nu} NO(g) + O(g)$ ii) Smog

8. Particulate of matter, Ozone and $H_2O_2$