

NCERT Solutions for Class 11 Chemistry Chapter 14 Environmental Chemistry

Question 14.1. Define environmental chemistry.

Answer :

Environmental chemistry

It is a branch of chemistry which deals with the chemical change, transport reactions, effects and fates of chemical species in the environment. It has three main components:-

- Abiotic (non-living thing)
- Biotic(living things)
- Energy component

Question 14.2. Explain tropospheric pollution in 100 words.

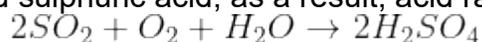
Answer :

Tropospheric pollution, the main cause of this pollution is due to the presence of undesirable substances such as solid or gaseous particles in the lowest layer of the atmosphere.

Major pollutants present in the troposphere-

1. Gaseous Pollutants-These is mainly, the oxides of the sulphur(SO_2 & SO_3), nitrogen and carbon, hydrogen sulphide(H_2S), hydrocarbons, ozone and other oxidants.
2. Particulate pollutants- Dust, mist, fumes and smog etc are the main constituents.

Oxides of sulphur and nitrogen are produced by the burning of fossil fuels like coal and automobile fuel and when these gases react with the water to form nitric acid (HNO_3) and sulphuric acid, as a result, acid rain is formed.



Acid rain causes harm to plants, trees, and agriculture. It also leads to respiratory problem.

When we burn hydrocarbons (contains hydrogen and carbon) they produce the oxides of carbon. Hydrocarbons are carcinogenic in nature and so that their products are also major pollutants. Carbon monoxide (CO), produced from incomplete combustion of carbon. It has the ability to block the delivery of oxygen to the organs and tissues.

Though carbon dioxide is not toxic in nature, it contributes towards global warming by trapping the reflected IR rays.

Particulates of smoke, mist, dust and fumes are harmful to us because they can block our nasal passage and cause many respiratory ailments.

Question 14.3. Carbon monoxide gas is more dangerous than carbon dioxide gas.

Why?

Answer :

Yes, carbon monoxide is more poisonous than carbon dioxide, (non-toxic in nature). CO has the ability to block delivery of oxygen to the organ and tissue. Also, it binds to haemoglobin to form a complex carboxyhaemoglobin, which is 300 times more stable than the oxygen-haemoglobin complex.

If the concentration of these complex reaches 3-4% then the capacity of blood to carry oxygen is reduced.

On the other hand, CO_2 is not poisonous, it is harmful only at high concentration.

Question 14.4. List gases which are responsible for greenhouse effect.

Answer :

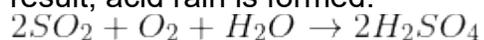
The following gases are responsible for the greenhouse effect-

1. Carbon dioxide (CO_2)
2. Methane (CH_4)
3. Water (H_2O)
4. Nitrous oxide (NO)
5. Ozone (O_3)
6. Chlorofluorocarbons (CFC_s)

Question 14.5. Statues and monuments in India are affected by acid rain. How?

Answer :

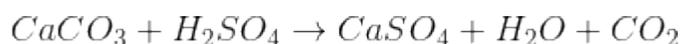
Oxide of sulphur and nitrogen reacts with water in the presence of dioxygen(O_2), as a result, acid rain is formed.



Acid rain cause damages to the buildings and structures made of stone and marble and metals. In India, for the construction of monuments and statues, we use limestone, including Taj Mahal.

Acid rain on reacting with limestone decolourise the surface of the stone also their lustre.

The reaction between limestone and acid rain-



Question 14.6. What is smog? How is classical smog different from photochemical smogs?

Answer :

Smog is a mixture of smoke and fog. It is the pollutants of air pollution. It affects our eyesight during the winter. There are two types of smog-

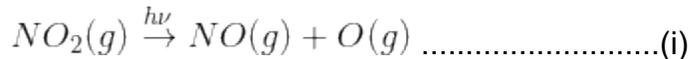
1. **Classical smog** - It occurs in a cool, humid climate. It is reducing in nature and it has smoke, fog and sulphur dioxide.
2. **photochemical smog**- It occurs in a dry and sunny climate. It is oxidising in nature and its components are PAN, ozone and nitric oxide etc.

Question 14.7. Write down the reactions involved during the formation of photochemical smog.

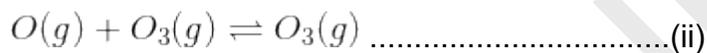
Answer :

Following reaction are involved during the formation of photochemical smog-

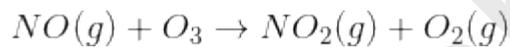
It is formed by the reaction of sunlight with hydrocarbons and nitrogen oxides. Burning of hydrocarbons leads to release of nitrogen oxide in the atmosphere and high concentration of these pollutants, a chain reaction by the interaction with sunlight.



Oxygen atoms are very reactive and combine with the dioxygen to produce ozone.



It rapidly reacts with NO, formed in the first reaction and regenerate $NO_2(g)$



Both NO_2 and ozone are oxidising in nature so they react with the unburnt hydrocarbon in the air to form PAN, formaldehyde and acrolein.



Question 14.8. What are the harmful effects of photochemical smog and how can they be controlled?

Answer :

Harmful effects of photochemical smog-

- Because of their oxidising nature, NO_2 and O_3 , causing corrosion of metals, stone, rubber and painted surface.
- Ozone and nitric acid are eye irritants, the nose and throat and due to the high concentration of these causes headache, chest pain, and difficulty in breathing.

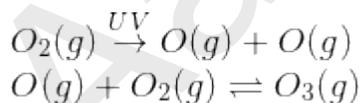
Control measure-

- by controlling the primary precursors, such as NO_2 and hydrocarbons, secondary precursors will be automatically reduced.
 - Use of catalytic converters is used in the automobiles, which prevent the release of nitrogen oxide and hydrocarbons to the atmosphere.
- plantation of certain plants such as Pinus, Juniperus, Quercus, Pyrus and Vitis can metabolise nitrogen oxide

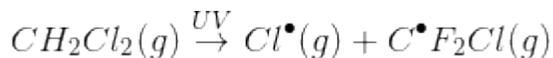
Question 14.9 . What are the reactions involved for ozone layer depletion in the stratosphere?

Answer :

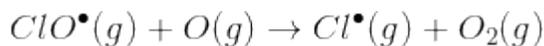
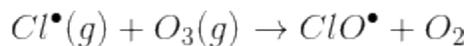
In the stratosphere, when UV radiation acting on dioxygen (O_2), the ozone molecule is formed. The UV rays split the dioxygen into free oxygen.



Once CFCs are released in the atmospheric gases and reach the stratosphere, they get broken down by UV radiation.



Then chlorine radical reacts with an ozone molecule to form chlorine monoxide radicals-



Question 14.10. What do you mean by ozone hole? What are its consequences?

Answer :

The depletion of the ozone layer due to the chlorine-free radical $Cl^\bullet + O_3(g) \rightarrow ClO^\bullet(g) + O_2(g)$, which is continuously regenerated at the stratosphere. This phenomenon is known as the ozone hole.

Effects of depletion of the ozone layer-

- With the depletion of the ozone layer, more amount of the UV radiation will enter the earth's atmosphere.
- UV radiations are harmful to us because they lead to skin damage, ageing of the skin, cataract, skin cancers and sunburns.
- It increases the evaporation of surface water through the stomata of the leaves and reduces the moisture content from the soil.
- Plants proteins are also affected by UV radiation, which leads to the mutation of cells.

Question 14.11. What are the major causes of water pollution? Explain.

Answer :

The major cause of water pollutions are -

1. **Radioactive waste** - These waste substances are direct throw into the oceans.
2. **Pathogens** - include bacteria and other organisms, which enters into the water from animal excreta and domestic sewage. Also, human excreta contain bacterias like *Escherichia coli* and *Streptococcus faecalis* which cause gastrointestinal diseases
3. **Organic Wastes** - These are biodegradable waste that pollutes water as a consequence of runoff. The excess of organic matter in water causes a decrease in the amount of oxygen held by the water.
4. **Chemical pollutants** - water-soluble inorganic chemicals such as heavy metals like cadmium, mercury, nickel etc. The presence of these metals in the human body, damages the kidneys, central nervous system, liver etc. These are dangerous for human beings because our body cannot excrete them.

Question 14.12. Have you ever observed any water pollution in your area? What measures would you suggest to control it?

Answer :

Following measurements should be taken to avoid water pollution-

1. Industrial and chemical discharges should be made free from all the toxic metals before throwing them into water bodies.
2. The concentration of these heavy metals should be checked regularly.
3. Compost should be preferred instead of using chemical fertilizers in agricultural fields to prevent the toxic chemical from entering groundwater.

Question 14.13. What do you mean by Biochemical Oxygen Demand (BOD)?

Answer :

Biochemical Oxygen Demand (BOD)

It is the amount of oxygen required by bacteria to decompose the organic matter present in a certain volume of the sample of water. Clean water would have a BOD value less than 5 ppm and highly polluted water could have a BOD value of 17 ppm.

Question 14.14. Do you observe any soil pollution in your neighbourhood? What efforts will you make for controlling the soil pollution?

Answer :

Mostly, soil pollution is due to the industrial wastes and agricultural pollutants such as herbicides, pesticide and fertilisers etc.

Pesticide like DDT is not soluble in water so that they remain in the soil for a very long period, causing the contamination of roots of crops. Aldrin and Dieldrin are non-biodegradable pesticides and highly toxic.

A suitable way for controlling the soil pollution is to avoid the direct addition of pollutants to the soil. And also wastes should undergo proper treatment. They should be first recycled and only then, allowed to dump.

Question 14.15. What are pesticides and herbicides? Explain giving examples.

Answer :

A **pesticide** is used to kill pests, including insects, plant pathogens etc It is a mixture of two or more substance. Aldrin and Dieldrin are common pesticides. Herbicides are used to kill the weeds. for example sodium chlorate ($NaClO_3$), sodium arsenite (Na_3AsO_3).

Question 14.16. What do you mean by green chemistry? How will it help decrease environmental pollution?

Answer :

Green chemistry is a way of thinking, by utilising the existing knowledge and principles of chemistry and other methods to reduce the adverse impact on the environment.

Green chemistry is a production process which brings minimum pollution to the environment. In this, the chemical reactants are, which give 100% end products.

Question 14.17. What would have happened if the greenhouse gases were totally missing in the earth's atmosphere? Discuss.

Answer :

The most abundant greenhouse gases are CO_2 , CH_4 , O_3 and CFCs and water vapour. If all these gases are missing from the earth's atmosphere, the temperature of the earth will reduce drastically, as a result, life will be too difficult for living creatures.

Question 14.18. A large number of fish are suddenly found floating dead on a lake. There is no evidence of toxic dumping but you find an abundance of phytoplankton. Suggest a reason for the fish kill.

Answer :

The abundance of phytoplankton causes the reduction of dissolved oxygen present in water. This is due to the decomposition of phytoplankton by bacteria present in water requires a large amount of oxygen. Hence, they used the dissolved oxygen in the water. Thus the BOD level of water reduced below a certain level, preventing the growth of fish and causing excessive fish-kill.

Question 14.19. How can domestic waste be used as manure?

Answer :

According to the nature of the waste material. It can be divided into two categories one is bio-degradable, and the other is non-bio degradable. For example, leaves, papers, rotten food etc. are under the type of biodegradable waste. These should be deposited in the landfills, where they can get decomposed by the bacteria anaerobically into manure. And non-biodegradable waste is sent for recycling.

Question 14.20. For your agricultural field or garden you have developed a compost producing pit. Discuss the process in the light of bad odour, flies and recycling of wastes for a good produce.

Answer :

We need to take proper care of the compost producing pit in order to prevent bad odour and flies. It should be kept covered to minimise the bad odour spreading and prevent flies from entering it. In the compost producing pit, put only bio-degradable waste, do not throw the recyclable waste.

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