

CHAPTER 14

Environmental Chemistry I

ATMOSPHERE

Important Question/Answers

QUESTION .1

What is the composition of the atmosphere?

ANSWER

Atmosphere

The layer of gases that cloaks (cover) Earth and consists of the air we inhale is known as an atmosphere. It is kept close to the planet's surface by the gravitational pull of Earth.

Composition

The by-products of the life that it supports dominate the composition of the atmosphere on Earth. 0.038% of carbon dioxide, 20.95% of oxygen, 78.08% of nitrogen, and 0.93% of argon are all present in dry air from the earth's atmosphere.

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QUESTION .2

What are the layers of the atmosphere and their functions?

ANSWER

Atmosphere

The layer of gases that cloaks Earth and consists of the air we breathe is known as an atmosphere. It is kept close to the planet's surface by the gravitational pull of Earth

Atmospheric Layers

The five separate layers of the atmosphere are a result of the temperature variations that occur with height. The Earth's atmosphere is divided into four levels, as follows:

Troposphere

Stratosphere

Mesosphere

Thermosphere

Troposphere

The lower component of the atmosphere is called the troposphere. Starting at ground level, it rises to a height of roughly 10 kilometers above sea level. The boundary layer,

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which is the lowest layer of the troposphere, and the tropopause, which is the uppermost layer 75% of the air in the atmosphere is found in the troposphere. Since this layer contains 99% of the atmosphere's water vapor, it is where the majority of clouds form. As you ascend higher in the troposphere, temperature and air pressure decrease. A packet of air expands as it travels upward. Air cools down as it expands. The air at Earth's surface absorbs the sun's energy, becomes heated up, and travels upward as a result, causing it to cool down. For this reason, the base of the troposphere is warmer than its base.

Stratosphere

The stratosphere sits above the troposphere and reaches a height of about 50 km (31 miles) above the surface. The stratosphere contains the ozone layer. This layer's ozone molecules turn the sun's intense ultraviolet (UV) light into heat by absorbing it. As a result, unlike the troposphere, the stratosphere warms up as you ascend!

Mesosphere

The mesosphere rises to a height of roughly 85 kilometers (53 miles) above the stratosphere. As you ascend through the mesosphere, the temperature drops here. This layer contains the coldest regions of our atmosphere, which can get as low as -90°C

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Thermosphere

The thermosphere, which is located above the mesosphere, is a zone where the temperature rises as you ascend. The sun's powerful UV and X-ray radiation is what is responsible for the temperature rise. However, because of how thin the air is, we would experience extreme cold in this stratum. Within the thermosphere, satellites circle the planet. The upper thermosphere can reach temperatures of up to 2,000 degrees Celsius. The thermosphere is where the aurora, often known as the Northern and Southern Lights, occurs.

QUESTION .3

What are the pollutants in the atmosphere and their sources?

ANSWER

Any physical, chemical, or biological change in the air is known as air pollution. The major effect of air pollution on plants, animals, and people is caused by noxious (harmful / poisonous) gases, dust, and smoke.

The atmosphere contains a specific proportion of gases. It is harmful to survival if the content of these gases increases or

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decreases. Global warming is the result of this imbalance in the composition of the gases in the atmosphere.

Types

Sulphur Oxides

Sulfuric acid production, industrial processes, and volcanic activity are the main sources of this pungent-smelling, colorless gas, respiratory problems, early deaths, and the inhalational destruction of certain nerves.

Carbon Monoxide

It is extremely poisonous. Carbon monoxide is a byproduct of incomplete combustion produced by internal combustion engines. Other sources are Volcanoes, forest fires, etc. are more sources. It also causes poisoning from carbon monoxide. It produces carboxyhemoglobin, which lowers the blood's ability to carry oxygen.

Nitrogen Oxides

Under NO_x, different Nitrogen Oxides are grouped.

They are generated by the high-temperature interaction between oxygen and nitrogen, which occurs in combustion engines and other industrial settings. It contributes in aggravating (making a problem) respiratory illnesses like

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asthma in people. Also contributes significantly to the development of SMOG and acid rain (nitric acid).

Methane

A petrochemical compound that is a gasoline additive. Which raises the risk of cancer and is a significant factor in bone marrow failure.

Chlorofluorocarbons (CFCs)

CFCs have an extensive use in aerosols, air conditioners, and freezers, etc. But are extremely harmful to the ozone layer.

Lead Compounds

One of the extremely dangerous metals is lead.

Lead can seriously harm a person's body in the following ways:

- Harm to the nervous system
- Intestinal problems
- Kidney injury
- Adverse effects on intelligence

Ozone

In the stratosphere, very beneficial, yet damaging at the earth layer. It is produced as a result of industries and cars. It is a greenhouse gas. Cause of extreme toxicity. It also causes itchy, watery eyes

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QUESTION .4

What are the sources of air pollution?

ANSWER

Sources Of Air Pollution

Natural Sources

The combustion of fossil fuels is the biggest cause of air pollution. When fossil fuels are burned inefficiently, harmful chemicals like carbon monoxide and sulphur dioxide are discharged into the environment, polluting the air.

Human Activities

Following are a few examples of human activities that contribute to air pollution:

The primary contributor to air pollution, sulfur dioxide (SO₂), is released by the burning of fossil fuels like coal and petroleum.

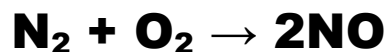
Vehicles fouled the air by releasing hazardous chemicals like carbon dioxide and carbon monoxide.

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Exhaust from factories and industries: These sources significantly lower air quality by releasing substantial amounts of organic chemicals and carbon monoxide into the atmosphere.



As a result of their interaction with ozone in the high atmosphere, chlorofluorocarbons thin the ozone layer, allowing ultraviolet (UV) radiation to penetrate it and reach the earth's surface. In addition to harming plants and animals, this UV radiation can also result in skin cancer and other illnesses in people.

QUESTION .5

What exactly causes global warming?

ANSWER

Global Warming

The steady increase in earth's temperature known as "global warming" is brought on by the greenhouse effect, which is

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caused by high amounts of carbon dioxide, CFCs, and other pollutants.

Explanation

About 75% of the solar energy that reaches Earth's surface is absorbed, raising its warmth. A portion of this energy is returned to the atmosphere. These gases, which include ozone, methane, carbon dioxide, water vapor, and chlorofluorocarbons, are referred to as **greenhouse gases** because they absorb some heat and prevent it from leaving our atmosphere. These gases contribute to the atmosphere's heating, which causes global warming.

The surface of the Earth receives more than 75% of the sun's radiation. The heat from the sun is reflected off the surface of the Earth, but some of it cannot escape the rising temperature because of greenhouse gases including carbon dioxide, methane, sulfur dioxide, and others.

These elements' molecules emit heat, and a sizable percentage of this heat returns to the earth's temperature.

As a result of this cycle's continual repetition, the earth's temperature rises. The Earth's temperature has risen by about 0.6°C over the last century.

QUESTION .6

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What are the major effects of Global warming?

ANSWER

Global Warming Effects:

- It causes earth temperature to rise gradually.
 - It also causes different climatic calamities.
 - Melting of polar ice causes the rising of sea levels
 - It is the main cause that our atmosphere is heating up.
-

QUESTION .7

What is acid rain? What are its effects?

ANSWER

Acid Rain

As the name implies, the simplest definition of acid rain is the precipitation of acid in the form of rain. Acid Rain occurs when contaminants from the atmosphere, such as oxides of nitrogen and sulphur, combine with precipitation and fall as rain.

Explanation

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Due to air pollutants, the high amounts of sulphur and nitrogen released by machines and industrial operations, acid rain is composed of water droplets that are highly acidic. Since this incorporates a variety of acidic precipitation, it is frequently called as acid rain.

Both wet and dry procedures are used to deposit acid.

Wet deposition

Any type of precipitation that removes acids from the atmosphere and deposits them on the earth's surface is referred to as wet deposition.

Dry deposition

Dry deposition of harmful gases and particles adheres to the ground through dust and smoke in the absence of precipitation.

Causes

Sulphur and nitrogen particles that entangle with the wet part of rain are the main components to acid rain. Both man-made, i.e., as emissions from businesses, and natural causes, such as lightning strikes in the atmosphere that release nitrogen oxides and volcanic eruptions that release sulphur oxide, can produce sulphur and nitrogen particles that mix with water.

Even though it is not safe, the rain we experience happens when water and carbon dioxide combine to make mild carbonic

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acid, which is not particularly dangerous on its own. What is happening is:



Regular rainfall has an acidic nature since its pH is 5.7. Along with the dust, the wind blows away the nitrogen and sulphur oxides. They descend as precipitation before settling on the surface of the earth. The main cause of acid rain is human activity, which releases nitrogen and sulfur oxides into the atmosphere.

Oxidation occurs with sulphur and nitrogen dioxide, which subsequently combine with water to produce sulphuric acid and nitric acid, respectively. The reaction that results in acid production will make things clearer:



QUESTION .8

What are the main effects of acid rain?

ANSWER

Effects of acid rain

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1. Animals, vegetation, and agriculture are all harmed by acid rain. All nutrients essential for plants and their survival are washed. The way acid rain maneuvers the soil's chemical composition has an effect on agriculture.
 2. It affects both people and animals' respiratory systems.
 3. The aquatic life is effected when acid rain falls to the ground and goes into ponds, rivers, and lakes. It results in water pollution and changes the chemical composition of the water in a way that makes it difficult for aquatic ecosystems to exist.
 4. In addition to corroding water pipes, acid rain also contributes to the leaching of heavy metals like iron, lead, and copper into drinking water.
 5. It harms structures and historical landmarks constructed of metal and stone.
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QUESTION .9

What is ozone depletion and its causes?

ANSWER

Ozone Depletion

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The earth is protected from the UV rays of the sun by the ozone layer, an area of the stratosphere with high ozone.

When chemical compounds containing gaseous bromine or chlorine are released into the atmosphere as a result of industrial activity or other human activities, the ozone layer on Earth gradually thins.

Explanation

The atmosphere's ozone layer gets damaged because of ozone layer depletion. This occurs when ozone molecules come in contact with with chlorine and bromine atoms in atmosphere and are destroyed. Ozone molecules can be deteriorated by one chlorine molecule. It is not made as quickly as it gets destroyed.

When exposed to ultraviolet radiation, some substances releases chlorine and bromine, which damages the ozone layer. Known as (ODS).

Causes

CFC, CCl_4 , hydro chlorofluorocarbons, and CHCl_3 are examples of that damage the ozone layer. While hydro bromofluorocarbons , CH_3Br , and halons are all ODS that include bromine.

The most predominant chemical that diminishes the ozone layer is chlorofluorocarbons. The only time the chlorine atom

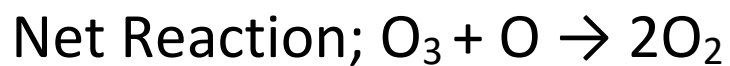
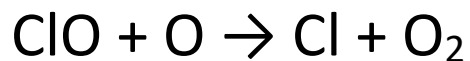
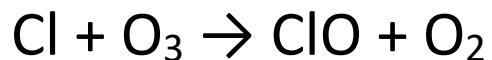
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does not react with ozone is when it interrelates with another molecule.

Reactions of ozone depletion



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