Chapter = 5

Environmental Chemistry-1 The Atmosphere

Q1. Define Environmental chemistry.

Environmental chemistry

It is the study of chemical species' origins, interactions, movement, impacts, and destinies in the air, soil, and water environments, as well as the impact of human and biological activities on these.

Q2. Define Atmosphere. Give its importance.

Atmosphere

Definition

The earth is surrounded by a layer of gases called the atmosphere.

Importance of atmosphere:

1. The atmosphere protects Earth like a big blanket of insulation.
2. It absorbs the heat from the Sun and keeps the heat inside the atmosphere helping the Earth to stay warm.
3. The big blanket also helps to form our weather patterns and climate.

Q3. Describe the Composition of atmosphere?

Composition of atmosphere

It is made up of nitrogen (78.09%) and oxygen (20.95%), with small amounts of argon (0.93%), carbon dioxide (0.03%), water vapour, and other gases. There are lots of other gases like neon, helium, hydrogen that are part of the atmosphere, but in much smaller amounts. Solid particulates including ash, dust, volcanic ash, etc. are also small parts of the atmosphere.

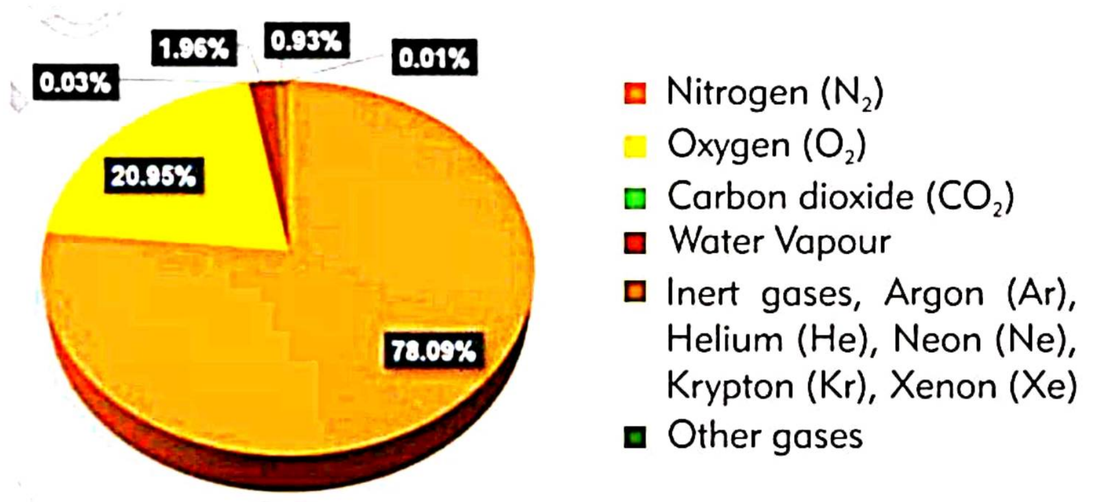
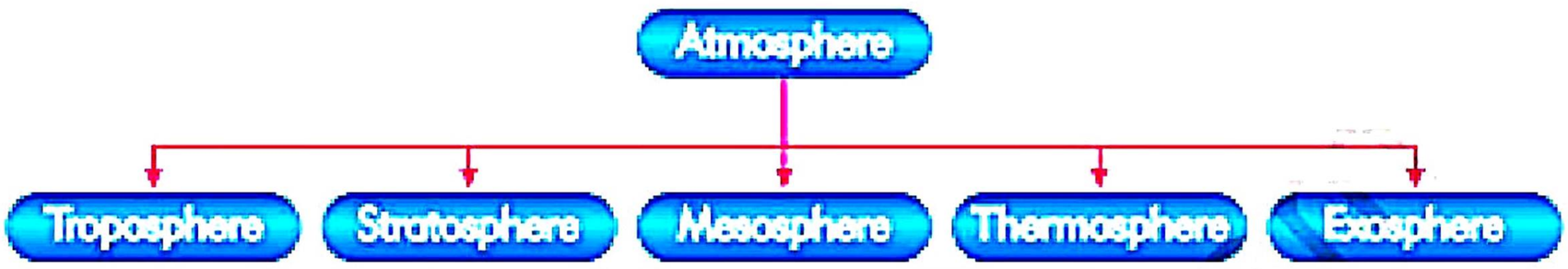


Figure Composition of atmosphere

Q4. What do you know about the Layers of atmosphere

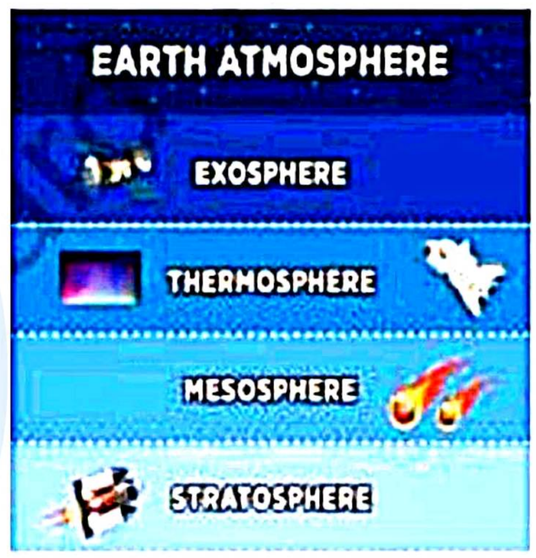
Layers of atmosphere

The Earth's atmosphere is divided up into 5 major layers. These layers are classified on the basis of temperature and density with respect to earth surface; following are the layers of the atmosphere, starting from the ground to upward:



Troposphere:

- The troposphere is the lowest layer of Earth's atmosphere.
- It extends from earth surface to an average height of about 12 km, although this altitude varies from about 9 to 17 km (9 km at the poles, 17 km at the Equator) above earth's surface.
- This is where we live and even where planes fly mostly.
- Around 80% of the mass of the atmosphere is in the troposphere.



Stratosphere:

- The stratosphere is the second lowest layer of Earth's atmosphere.
- It lies above the troposphere and is separated from it by the tropopause.
- This layer extends from the top of the troposphere at roughly 12 km above Earth's surface to the stratosphere at an altitude of about 50 to 55 km.

- The higher the altitude the hotter is the atmosphere. Unlike the troposphere the stratosphere gets its heat by the ozone layer absorbing radiation from the sun. As a result, it gets warmer the further away you get from the Earth.
- There are less water vapours and other substances in this layer. Weather balloons go as high as the stratosphere.

Q5. Distinguish between troposphere and stratosphere.

S.No.	Troposphere	Stratosphere
1.	It is the lowest point on the earth's surface.	It is the uppermost layer of the atmosphere after the troposphere.
2.	It stands at a height of around 11 km above sea level.	It rises up to 50 km above sea level.
3.	The troposphere makes up around 75% of the mass of the atmosphere.	The stratosphere has a far less amount of atmosphere then the troposphere.
4.	As you climb higher in this sphere the temperature drops steadily. It ranges in temperature from 15 °C to -56 °C.	The temperature fluctuates somewhat with height and usually the higher the altitude the hotter it gets.
5.	Ozone, which is found here, is a polluting gas.	The presence of ozone hair shields the planet from ultraviolet radiation.
6.	There is a lot of movement of the air, and this area is part of an active weather system.	There is a lack of air movement in this area.
7.	Almost all planes pass through this layer.	Airplanes are not permitted in this layer.
8.	N_2,O_2,CO_2 and water vapours are the most essential gases in this sphere.	In this layer water vapours and gases are quite low in quantity.

Q6.What is Pollutants? Give its causes and effects.

Pollutants

Definition: pakcity.org

A material or energy which is present in excess of the natural concentration and produces an adverse effect upon the environment is known as pollutant and the phenomenon is known as pollution.

Causes: Human activities produce and release these contaminants into the environment.

Effects:

1. They endanger human life by polluting the environment (air, water, and soil).
2. Pollutants in the air alter the weather, have a negative impact on human health, harm vegetation, and cause the destruction of structures.

Q7.Name the different types of air pollutant.

Types of pollutants: There are seven types of pollutants.

- Air pollutants
- Water pollutants
- Soil pollutants
- Thermal pollutants
- Radioactive pollutants
- Noise pollutants
- Light pollutants

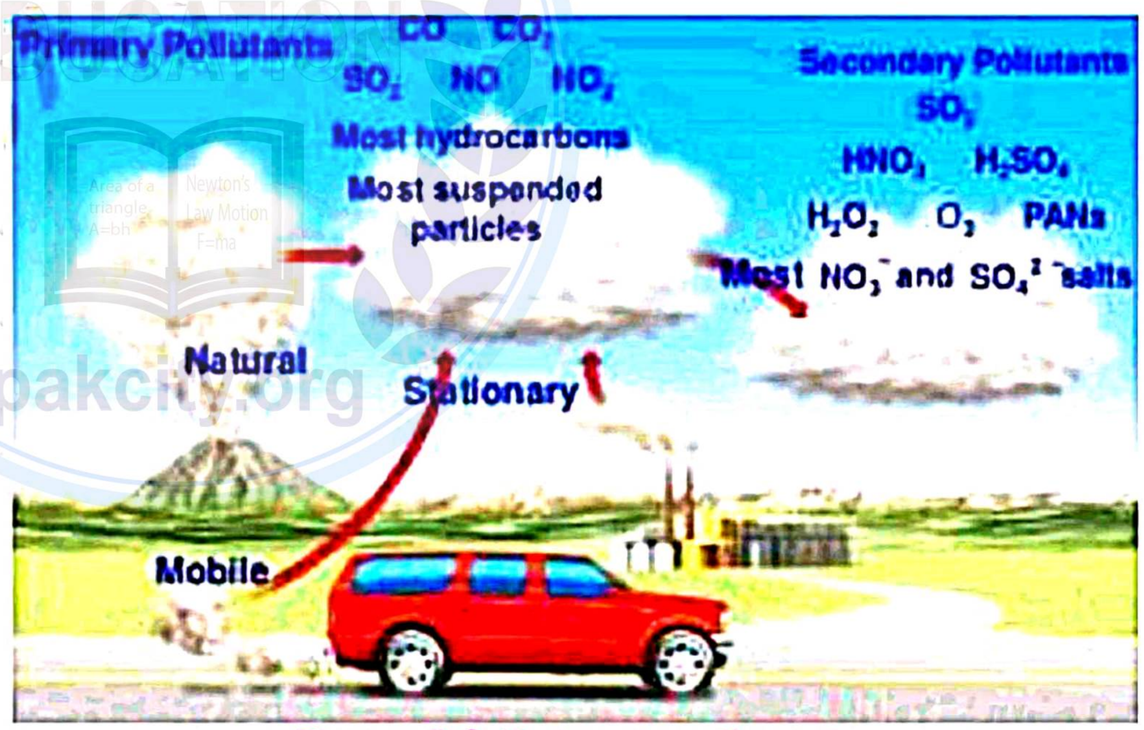


Figure 5.3 Major air pollutants

Q8.Name and discus the different Major air pollutants

Major air pollutants

Types of major air pollutants: There are two types of major air pollutants, which are following.

1. Primary air pollutants

2. Secondary air pollutants

Primary air pollutants:

The waste or exhaust products produced by the burning of fossil fuels and organic materials are referred to as primary pollutants. Sulphur oxides (SO_2), carbon oxide (CO_2 and CO), nitrogen oxides (especially nitric oxide NO), hydrocarbons (CH4), ammonia, and fluorine compounds are among them.

Secondary air pollutants: Primary pollutants create secondary pollutants through a variety of processes. Sulphruic acid, carbonic acid, nitric acid, hydrofluoric acid, ozone, and peroxyl acetyl nitrate (PAN) are secondary pollutants.

Q9.Give the sources of different pollutant their risk on our environment an effect on human?

Pollutant	Source	Environmental Risks	Human Health risks
Carbon Monooxide (CO)	Emissions from automobiles, fires, and industrial operations	causes the production of smog	In healthy persons, it can increase symptoms of cardiac disease, such as chest discomfort it can also Course visual difficulties and diminish physical and mental skills.
Nitrogen Oxide (NO and NO_2)	Emissions from automobiles, electrical generation, and industrial operations	It causes harm to the plats and helps to the creation of Pollution.	Inflammation and irritation of the respiratory tract.
Sulfur dioxide (SO_2)	Electricity generation, fossil-fuel burning. industrial activities and automotive emissions are all examples of Pollution sources.	Key contributor to the creation of acid rain, which destroys flora, buildings, and monuments; interacts to generate patricide matter	Having trouble breathing, especially if you have asthma or heart problems
Oxone (O_3)	NOx and VOCs from industrial and car emissions, gasoline vapours, chemical solvents, and electrical utilities are all sources of 0zone.	Interferes with certain plants capacity to breathe, making them more vulnerable to other environmental stresses (e.g. disease, harsh, weather)	Lung function is impaired, and breathing passage ways are irritated and inflamed.
Particular Matter	Fires, smokestacks, building sites, and unpaved roads are examples of primary particle sources; interactions between gaseous compounds released by power plants and	Contributes to the creation of haze and acid rain, which alters the pH balance of streams and harms vegetation, buildings, and monuments	breathing passage discomfort, asthma exacerbation, irregular heartbeat

	cars are examples of secondary particle sources.		
Lead (Pb)	Metal processing, garbage Incineration, and fossil-fuel burning are all examples of industrial processes.	Biodiversity loss, reduced reproduction and neurological difficulties in vertebrates are all issues that need to be addressed.	When young children are exposed, it can have negative effects on numerous body systems and can lead to learning problems. Adults cardiovascular consequences

Q10. What is acid rain? What are the Effects of acid rain?

Acid rain

Rainwater is somewhat acidic because it contains dissolved CO_2 from the atmosphere. It has a pH of 5.6 to 6. Rainwater, on the other hand, becomes increasingly acidic as a result of dissolving air pollutants (acids) and its drops pH to 4. Acid rain is created when rainwater dissolves acidic air pollutants like sulphur dioxide and nitrogen dioxide.

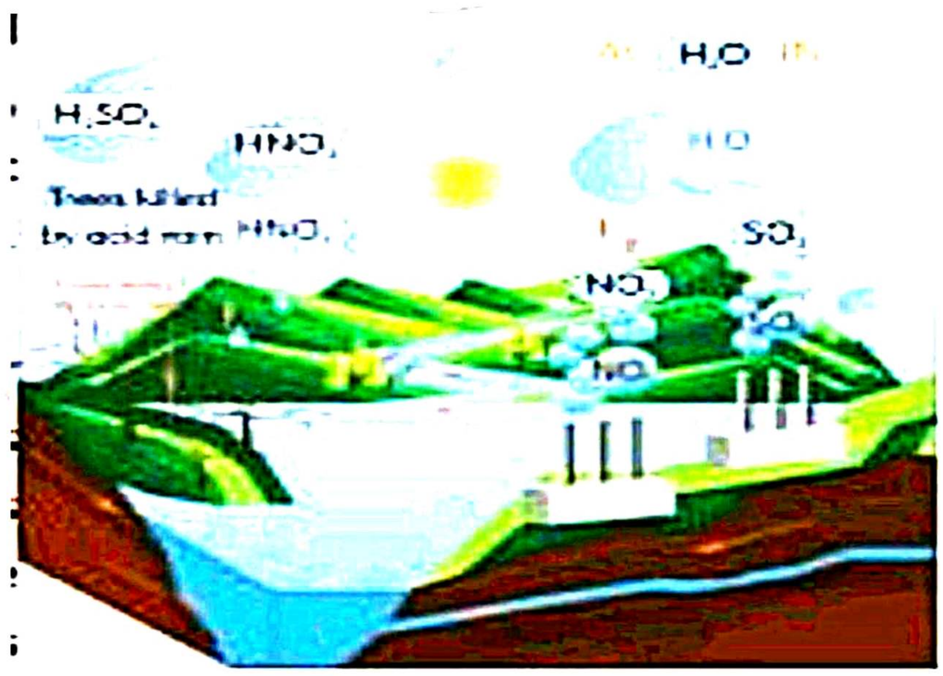


Figure 5.4
Acid rain

Effects of acid rain:

1. Acid rain leaches heavy metals (Al, Hg, Pb, Cr, etc.) from soil and rocks and discharges them into rivers and lakes.
2. The aquatic life in lakes, on the other hand, suffers as a result of the high concentration of these metals. It causes fish to suffocate and die as a result.
3. Acid rain eats away the calcium carbonate in marble and limestone, which is found in many structures and monuments. As a result, these structures are becoming increasingly drab and degraded.
4. Acid rain makes the soil more acidic. Many crops and plants are unable to thrive in such conditions. It also raises the levels of hazardous metals in the soil, which damage the plants.
5. Because of the acidity of the soil, even elderly trees are impacted. Their development is slowed. They wilt and perish as a result of the dryness.
6. Acid rain causes direct harm to tree and plant leaves, restricting their development. Plant development may be impeded depending on the severity of the injury.

Q11. What is Ozone? Discus its formation.

Ozone

Three oxygen atoms make up ozone (O_3), a highly reactive gas. It is a natural and man-made substance.

Formation of stratospheric ozone(O_3): The interaction of solar ultraviolet (UV) light with molecular oxygen produces stratospheric ozone (O_3).

Formation of tropospheric or ground level ozone(O_3): Photochemical interactions between two primary groups of air pollutants, volatile organic compounds (VOC) and nitrogen oxides, produce tropospheric or ground level ozone, in which humans breathe.

Q12. What do you know Ozone depletion? What are the effect of Ozone depletion?

Ozone depletion

Ozone concentration in the atmosphere is essentially constant under normal conditions due to a series of complicated atmospheric interactions.

However, different chemical interactions are depleting the ozone layer. Such as, chlorofluorocarbons (CFCs), which are utilized as refrigerants in air conditioners and refrigerators, are a major contribution to ozone depletion. These substances leak in some way and disperse into the stratosphere. The C-CL bond in $CFCl_3$ is broken by ultraviolet light, resulting in chlorine free radicals.

These free radicals have a high level of reactivity. They react with ozone to produce oxygen in the following way

$O^3 + Cl^o \rightarrow O^2 + OCl^o$

$OCl^o \rightarrow O^o + Cl^o$

$O^o + O^o \rightarrow O_2$

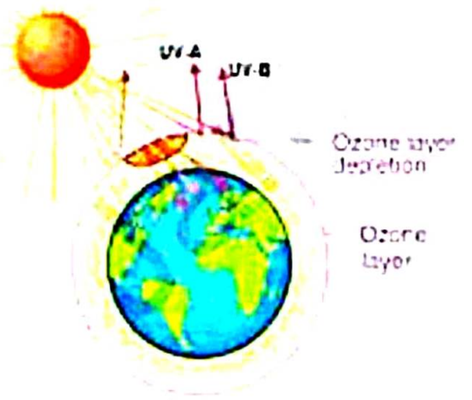


Figure 5.5
Ozone depletion

A single chlorine free radical produced by the breakdown of CFCs has the potential to damage millions of ozone molecules. The ozone hole is a location where the ozone layer is depleted.

Effect of ozone depletion:

1. Ozone depletion allows UV light from the Sun to reach the Earth, which can cause skin cancer in humans and other animals.
2. As the Ozone layer gets thinner, infectious illnesses such as malaria become more prevalent.
3. It has the potential to disrupt the food chain by altering plant life cycles.
4. It has the ability to alter wind patterns, resulting in global climate shifts. Asia and the Pacific, in particular, would be the most impacted regions, as a result of the human migration issue caused by climate change.

Q13. Give advantages and disadvantages of ozone layer

Advantages

This layer surrounds the Earth and acts as a screen against damaging UV radiation. UV rays would induce skin cancer if the Ozone layer were not present.

Disadvantages

The ozone layer, which is located about 6 to 30 miles above the earth's surface, decreases the quantity of dangerous UV light that reaches the Earth surface.

Q14. What is Green House Effect?

Green House Effect (Global Warming):

Despite the fact that CO_2 is a harmful gas, its rising concentration as a result of the combustion of fossil fuels in various human activities is concerning. CO_2 in the atmosphere works as a greenhouse's glass wall. It permits UV and IR radiations to pass through, but not the other way around. Some of the infrared light released by the Earth is trapped by it.

As a result, higher CO_2 concentration absorbs infrared radiation generated by the Earth's surface, preventing heat energy from existing the atmosphere. It aids in preventing the surface from cooling down at night. As CO_2 concentrations in the atmosphere rises, less thermal energy is lost from the Earth's surface. As a result, the surface's average temperature progressively rises. This is known as greenhouse effect. The quantity of CO_2 in the air has a direct relation with this impact. The greater the amount of CO_2, the greater the heat trapping or warming. This phenomenon is also known as global warming because of the increased temperature. Primary greenhouse gases in the earth atmosphere are water vapours, CO_2, CH_4, N_2O and ozone.

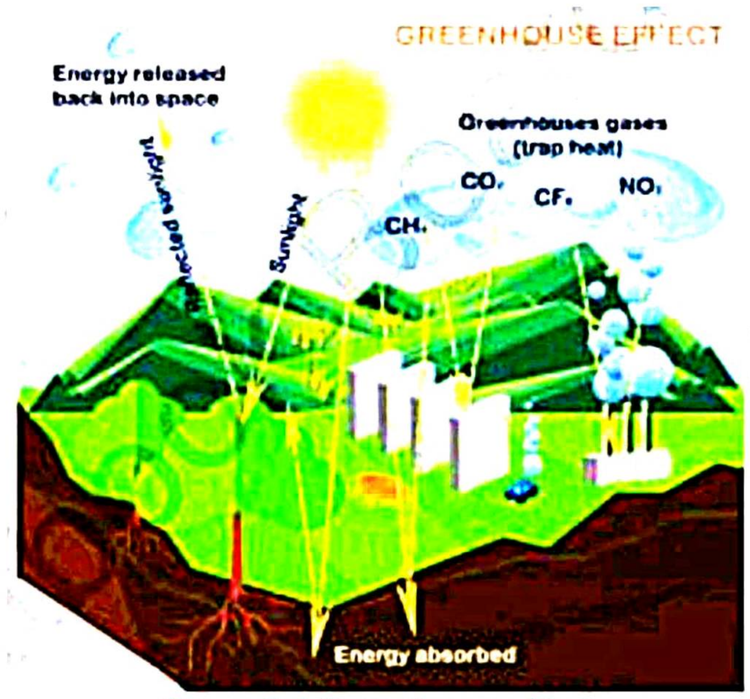


Figure 5.6 Green house effect

Q15. List some Effect of Global Warming.

Effect of Global Warming

1. The accumulation of carbon dioxide in the atmosphere causes an annual increase in atmospheric temperature of roughly 0.05 degree Celsius.
2. It's producing significant shifts in weather patterns. Extreme weather events are occurring more frequently and with more intensity than in the past.
3. It melts glaciers and snow caps, increasing the danger of flooding and intensifying tropical cyclones.
4. As the sea level rises, low-lying regions are more likely to be submerged, rendering previously populous places uninhabitable.

MULTIPLE CHOICE QUESTIONS

1. Second highest layer of Earth's atmosphere is

(a) stratosphere (b) mesosphere (c) troposphere (d) thermosphere

2. Aero planes fly in:

(a) Troposphere (b) Stratosphere (c) Mesosphere (d) Thermosphere

3. Atmospheric pressure decreases with the

(a) increase in altitude (b) decrease in altitude

(c) increase in altitude (d) increase in latitude

4. Layer of atmosphere which separates stratosphere and troposphere is known as

(a) tropo-pause (b) mesopause (c) tropopause (d) stratopause

5. Ozone layer is part of

(a) mesosphere (b) stratosphere (c) thermosphere (d) troposphere

6. Which is not part of greenhouse gases

(a) carbon dioxide (b) methane (c) nitrous oxide (d) oxygen

7. Second most abundant constituent of dry air in terms of volume after nitrogen is

(a) nitrogen (b) oxygen (c) carbon dioxide (d) helium

8. Which of the following is the reason of global warming

(a) Presence of sulphide (b) Rise in CO_2 concentration

(c) Oxides of nitrogen (d) Formation of ozone

9. The altitude on stratosphere is global warming

(a) 40 to 45 km (b) 50 to 55 km (c) 60 to 65 km (d) 70 to 75 km

10. Ozone is a gas found in the _____ layer:

(a) Troposphere (b) Mesosphere (c) Stratosphere (d) none

Ans:

1.thermospher e	2.Stratosphere	3.increase in altitude	4.tropo-pause	5.stratosphere
6.oxygen	7.oxygen	8.Rise in CO_2 concentration	9.50 to 55 km	10.Stratosphere