Class: 9th

Subject: Chemistry

Chapter 10: Environmental Chemistry

Exercise MCQs:

(i) Which gases are responsible for greenhouse effect?

(a) SO_2, NO_2

(b) NO_2, CO

(c) CO_2, CH_4 ✅

(d) O_2, N_2

(ii) Indicate the source of sulphur which is responsible for the presence of oxides of sulphur in the atmosphere.

(a) Decomposition of vegetation

(b) Waste gases from digestion of animals

(c) Photochemical smog

(**d**) Combustion of fossil fuels ✅

(iii) Concentration of which gas in the atmosphere is decreased by photosynthesis in plants?

(a) Oxygen

(b) Nitrogen

(**c**) Carbon dioxide ✅

(d) Water vapours

(iv) Which substance remains unaffected in the catalytic converter fixed in the exhaust of the automobiles?

(**a**) CO_2 ✅

(b) CO

(c) NO

(d) NO_2

(v) People of which age groups are most affected by the air pollution?

(a) Young adults

(b) Middle age people

(c) Children

(**d**) Both children and aged people ✅

(vi) In which area there is a greater possibility of acid rain?

(a) Around village

(b) Around big cities

(**c**) Around industrial area ✅

(d) Around water bodies

(vii) Why is smog not felt in summer?

(**a**) Because fog is not present in summer ✅

(b) Because due to heat of the Earth the smoke rises up

(c) Because in summer smoke and fog cannot mix with each other

(d) Because less fossil fuels are burnt in summer

(viii) Which catalyst is used in the catalytic converter fixed in the exhaust systems of automobiles?

(a) Ni

(b) Cu

(c) Pt, Pd and Rh ✅

(d) CaO

(ix) Which components are essential for the formation of photochemical smog?

(a) CO, NO, CO

(b) NO_2, volatile organic compounds, sunlight ✅

(c) CO_2, NO_2, sunlight

(d) Volatile organic compounds, NO_2, CO

(x) Which gases contribute towards the formation of acid rain?

(a) Oxides of carbon

(b) Oxides of sulphur

(c) Oxides of nitrogen

(d) Both the oxides of nitrogen and sulfur ✅

Important MCQs:

1. Which gas is present in the largest amount in

Earth's atmosphere?

(a) Oxygen

(b) Carbon dioxide

(c) Nitrogen ✅

(d) Hydrogen

2. What is the role of carbon dioxide in the atmosphere?

(a) Helps in breathing

(b) Helps plants in making food ✅

(c) Causes ozone depletion

(d) Causes acid rain

3. Which term refers to harmful substances in the air?

(a) Nutrients

(b) Pollens

(c) Air pollutants ✅

(d) Gases

4. The concentration of air pollutants is measured

in:

(a) Grams per litre

(b) Percentage

(c) Parts per million (ppm) ✅

(d) Molarity

5. Which gas is produced by incomplete combustion of fossil fuels?

(a) Carbon dioxide

(b) Carbon monoxide ✅

(c) Nitrogen

(d) Oxygen

6. Methane is released into the atmosphere by:

(a) Photosynthesis

(b) Acid rain

(c) Decomposition of vegetation ✅

(d) Fossil fuel purification

7. Ozone in lower atmosphere is formed by reaction between:

(a) CO_2 and sunlight

(b) hydrocarbons in sunlight ✅

(c) O_2 and water vapour

(d) Dust and fog

8. What is smog?

(a) Mixture of dust and air

(b) Smoke and fog mixture ✅

(c) Water and sulphur

(d) Nitrogen and methane

9. The major source of air pollution is:

(a) Forest growth

(b) Combustion of fossil fuels ✅

(c) Ocean currents

(d) Plant respiration

10. Which of the following is a particulate pollutant?

(a) Nitrogen

(b) Methane

(c) Dust ✅

(d) Oxygen

11. What is the pH range of acid rain?

(a) 3.0 – 3.5

(b) 4.2 – 4.4 ✅

(c) 5.0 – 6.0

(d) 6.5 – 7.0

12. Who is known as the "Father of Acid Rain"?

(a) Joseph Priestley

(b) Antoine Lavoisier

(c) Robert Angus Smith ✅

(d) John Dalton

13. Which gases are mainly responsible for acid rain?

(a) CO_2 and CH_4

(b) O_2 and N_2

(c) SO_2 and NOx ✅

(d) H_2 and He

14. How are nitrogen oxides (NOx) formed in the

atmosphere?

(a) From photosynthesis

(b) By burning wood

(c) By lightning and combustion processes ✅

(d) By evaporation of acids

15. What do SO_2 and NOx form after mixing with atmospheric moisture?

(a) Smoke

(b) Acid droplets ✅

(c) Fog

(d) Dust particles

16. Which of the following is not an effect of acid rain?

(a) Soil becomes more fertile ✅

(b) Damage to vegetation

(c) Harm to aquatic life

(d) Corrosion of buildings

17. How does acid rain affect aquatic life?

(a) Increases oxygen

(b) Makes water too acidic ✅

(c) Produces more algae

(d) Reduces CO_2

18. What is used by farmers to reduce acid rain's effect on soil?

(a) Urea

(b) Ash

(c) Crushed lime (CaO) ✅

(d) Baking soda

19. What happens if trees are destroyed by acid rain?

(a) Soil becomes alkaline

(b) Soil is washed away ✅

(c) CO_2 increases

(d) Rainfall increases

20. Which world-famous building is being damaged by acid rain?

(a) Eiffel Tower

(b) Great Wall of China

(c) Taj Mahal ✅

(d) Statue of Liberty

21. What is the Greenhouse Effect?

(a) Cooling of Earth due to pollution

(b) Heating of Earth due to greenhouse gases ✅

(c) Decrease in rainfall

(d) Melting of glaciers

22. Which radiation is trapped by greenhouse gases at night?

(a) UV radiation

(b) Shortwave radiation

(c) Longwave radiation ✅

(d) Microwaves

23. Which of the following is NOT a greenhouse gas?

(a) Methane

(b) Water vapour

(c) Nitrogen ✅

(d) Carbon dioxide

24. What is the main reason for the increase of greenhouse gases in the atmosphere?

(a) Ocean waves

(b) Burning of fossil fuels ✅

(c) Use of fertilizers

(d) Volcanic eruptions

25. Which human activity reduces the ability of the atmosphere to remove CO_2?

(a) Use of solar panels

(b) Deforestation ✅

(c) Rainwater harvesting

(d) Reforestation

26. What does the greenhouse gas layer do?

(a) Blocks sunlight

(b) Reflects UV rays

(c) Traps heat on Earth ✅

(d) Absorbs oxygen

27. Which greenhouse gas is produced by rice fields and animal digestion?

(a) CO_2

(b) Methane ✅

(c) Ozone

(d) NO_2

28. What will be the effect of global warming on sea levels?

(a) No effect

(b) Sea level will fall

(c) Sea level will rise ✅

(d) Sea will dry

29. Which crops may be negatively affected by global warming?

(a) Wheat and rice

(b) Maize and sugarcane ✅

(c) Barley and cotton

(d) Tea and coffee

30. How will global warming affect the seasons in moderate regions?

(a) Summer will be shorter

(b) Winter will be longer

(c) Summer will be longer and hotter ✅

(d) No change in seasons

31. What is the role of trees in reducing air pollution?

(a) They produce CO_2

(b) They absorb oxygen

(c) They absorb carbon dioxide and release oxygen ✅

(d) They emit methane

32. Which pigment in plants helps in photosynthesis?

(a) Hemoglobin

(b) Carotene

(c) Chlorophyll ✅

(d) Melanin

33. What is the function of catalytic converters in vehicles?

(a) Increase engine speed

(b) Reduce harmful emissions ✅

(c) Remove dust from tires

(d) Clean windshields

34. Which gas is reduced to nitrogen and oxygen by catalytic converter?

(a) CO_2

(b) NOx ✅

(c) SO_2

(d) CH_4

35. Which gas is formed when carbon monoxide is oxidized?

(a) CH_4

(b) CO_2 ✅

(c) SO_2

(d) H_2

36. Which substance is used in flue gas desulphurization to remove SO_2?

(a) Sodium chloride

(b) Magnesium oxide

(c) Calcium oxide ✅

(d) Potassium hydroxide

37. What are renewable sources of energy?

(a) Fossil fuels

(b) Solar and wind energy ✅

(c) Diesel and petrol

(d) Nuclear fuels

38. What is considered a good Air Quality Index (AQI)?

(a) Above 300

(b) Between 200–300

(c) Between 100–200

(d) Below 50 ✅

39. Which type of mask is more effective against air pollution?

(a) Surgical mask

(b) Cloth mask

(c) N95 mask ✅

(d) No mask is effective

40. Why are people over 65 considered at high risk in air pollution?

(a) They have weak memory

(b) They have more body strength

(c) Their lungs and heart are more vulnerable ✅

(d) They exercise more

Exercise Short Questions:

i. What is the main objective of environmental education?

The main objective of environmental education is to create awareness among people about environmental issues and to encourage them to take actions for the protection and improvement of the environment.

ii. How is particulate matter released in the atmosphere?

Particulate matter is released in the atmosphere through the burning of fossil fuels by vehicles, factories, and power plants.

iii. Which gas is more poisonous, CO_2 or CO?

Carbon monoxide (CO) is more poisonous than carbon dioxide (CO_2) because it binds with hemoglobin and reduces the oxygen-carrying capacity of blood.

iv. How does acid rain affect forests?

Acid rain damages leaves, affects the growth of plants, and makes the soil less fertile by removing essential nutrients, which harms forest ecosystems.

v. In what way sulphur present in fossil fuels

becomes dangerous?

When sulphur in fossil fuels burns, it produces sulphur dioxide (SO_2), which contributes to air pollution and causes acid rain.

vi. Name any three major sources responsible for the greenhouse effect.

Three major sources are:

1. Carbon dioxide (CO_2) from burning fossil fuels
2. Methane (CH_4) from agriculture and waste
3. Nitrous oxide (N_2O) from fertilizers and industrial activities

vii. How is wind energy useful for us?

Wind energy is used to generate electricity without causing pollution. It is a renewable, clean, and sustainable source of energy.

Important Short Questions:

1. What is the atmosphere and what does it consist of?

The atmosphere is a blanket of air covering the Earth, made up of several layers of gases like nitrogen, oxygen, carbon dioxide, and others.

2. Which gas is present in the highest amount in the atmosphere?

Nitrogen is the gas present in the highest amount, about 78%.

3. What is the difference between major and minor constituents of the atmosphere?

Major constituents are gases present in large amounts like nitrogen and oxygen, while minor constituents are present in smaller amounts like carbon dioxide and noble gases.

4. Which gas is released when carbonated drinks are opened?

Carbon dioxide (CO_2) is released when carbonated drinks are opened.

5. What is meant by an air pollutant?

An air pollutant is any substance (solid, liquid, or gas) in the air that has an adverse effect on human

health and the environment.

6. In which unit is the concentration of air pollutants measured?

The concentration of air pollutants is measured in parts per million (ppm).

7. Name the seven major air pollutants.

Carbon dioxide (CO_2), carbon monoxide (CO), oxides of nitrogen (NO, NO_2), oxides of sulphur (SO_2), hydrocarbons (methane, ethane), particulates (dust, pollen), and ozone (O_3).

8. Which pollutants are produced by burning fossil fuels?

Burning fossil fuels produces carbon dioxide, carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbons, ash, smoke, and particulates.

9. What types of pollutants are released during a volcanic eruption?

Volcanic eruptions release large quantities of carbon dioxide, sulphur dioxide, and particulates.

10. What is smog and how is it formed?

Smog is a mixture of smoke and fog formed when pollutants like nitrogen oxides, sulphur dioxide, particulate matter, and volatile organic compounds accumulate in the air, especially in winter.

11. What is acid rain? What is its usual pH range?

Acid rain is rainwater that has a pH between 4.2 and 4.4 due to the presence of acidic gases dissolved in it.

12. How are sulphur dioxide (SO_2) and nitrogen oxides (NO_x) involved in acid rain formation?

SO_2 and NO_x gases mix with moisture in the air forming acidic droplets which fall as acid rain.

13. What are the major effects of acid rain on plants and soil?

Acid rain makes soil acidic, washing away nutrients and harming plants, many of which cannot grow in acidic soil.

14. How does acid rain affect aquatic life?

Acid rain increases water acidity in lakes and rivers, making it difficult for aquatic animals like fish to

survive.

15. Mention two ways acid rain damages human-made structures.

Acid rain corrodes buildings and monuments made of stone and metal, damaging historical sites.

16. What causes the increase of greenhouse gases in the atmosphere?

Burning fossil fuels like coal, oil, and natural gas increases carbon dioxide and other greenhouse gases.

17. Define the greenhouse effect in simple words.

The greenhouse effect is the trapping of heat by gases in the atmosphere, which warms the Earth's surface.

18. Name three major greenhouse gases.

Carbon dioxide (CO_2), methane (CH_4), and water vapour (H_2O) are major greenhouse gases.

19. How does cutting down trees affect global warming?

Fewer trees reduce the removal of CO_2 from the air, increasing greenhouse gas concentration and warming.

20. Why is methane considered a harmful greenhouse gas?

Methane traps heat more effectively than CO_2 and its concentration increases due to decay of vegetation and animal digestion.

21. Explain how global warming causes a rise in sea levels and mention two areas threatened by this rise.

Global warming increases Earth's temperature, causing seawater to expand and glaciers in places like Antarctica and Greenland to melt. This leads to a rise in sea levels, which threatens low-lying coastal areas such as the Netherlands and Bangladesh.

22. Discuss the impact of increased rainfall due to global warming on flooding and living species.

Higher global temperatures can cause increased

evaporation and more rainfall in some areas. This may lead to widespread flooding, which can destroy habitats, threaten human settlements, and endanger the survival of various species.

23. Compare the effect of global warming on different crops like wheat, rice, maize, and sugar cane.

Crops like wheat and rice may grow better in slightly warmer temperatures. However, maize and sugarcane do not thrive in high temperatures, so global warming can negatively affect their production.

24. Describe the changes in seasonal patterns (summer and winter) caused by global warming in moderate regions.

In moderate regions, global warming causes shorter and warmer winters and longer and hotter summers. This disrupts weather patterns and can affect ecosystems and human life.

25. How do plants contribute to reducing air pollution? Explain the process involved.

Plants remove carbon dioxide through photosynthesis, a process where they absorb CO_2 and release oxygen in the presence of sunlight and chlorophyll. They also trap dust and particulate matter on their leaves, branches, and trunks.

26. What are catalytic converters, and how do they reduce harmful emissions from automobiles?

Catalytic converters are devices in automobile exhaust systems. They:

Convert nitrogen oxides into nitrogen and oxygen.

Convert carbon monoxide into carbon dioxide.

Convert hydrocarbons into CO_2 and H_2O.

These reactions reduce toxic gas emissions from vehicles.

27. Explain the flue gas desulphurization process and its importance in controlling sulphur dioxide pollution.

Flue gas desulphurization removes sulphur dioxide (SO_2) from waste gases of power plants. It uses adsorbents like calcium oxide, which can remove up

to 95% of SO_2, helping to reduce acid rain and air pollution.

28. Why is it necessary to shift towards renewable energy resources? Give examples of such resources.

Fossil fuels cause pollution and are limited. Renewable energy sources like solar energy, wind energy, water, and biomass are clean and sustainable. They help in reducing carbon emissions and protecting the environment.

29. Define the Air Quality Index (AQI) and explain what the different levels indicate regarding health risks.

AQI is a rating system for air pollution.

- Below 50: Safe
- 51–100: Moderate risk
- 101–300: Unhealthy, especially for sensitive groups
- Above 300: Hazardous

High AQI can cause serious health issues,

especially for children, the elderly, and people with heart or lung diseases.

30. What steps should be taken to protect high-risk groups during periods of poor air quality?

- Reduce time spent outdoors.
- Wear N95 masks for better protection.
- Keep doors and windows closed.
- Use air conditioners or purifiers.
- Install carbon monoxide detectors.
- Consult a doctor if symptoms appear.

Important Long Questions:

Q1:Describe the composition of Earth's atmosphere. Explain the major and minor constituents with their percentages.

The Earth is surrounded by a layer of gases called the atmosphere, which is essential for life. The

atmosphere is composed of both major and minor gases, each playing a unique role.

Major Constituents:

Nitrogen (N_2) – 78%

Nitrogen is the most abundant gas. It is inactive and helps in diluting oxygen to prevent rapid burning.

Oxygen (O_2) – 21%

Oxygen is essential for respiration in animals and combustion.

Minor Constituents:

Argon (Ar) – 0.934%

It is a noble gas and does not react easily with other elements.

Carbon Dioxide (CO_2) – 0.04%

- CO_2 is necessary for photosynthesis in plants and contributes to the greenhouse effect.
- Noble Gases (like neon, helium, krypton, xenon) – about 1% combined
- These are chemically inactive and present in

very small amounts.

- Water Vapours – Variable
- The amount varies depending on humidity. It plays a role in weather and rainfall patterns.

Q2: What is the importance of atmosphere for life on Earth? How does its composition support both plants and animals?

The atmosphere acts as a protective shield and supports life in the following ways:

- **Oxygen** in the **atmosphere** is vital for respiration in animals and humans.
- **Carbon dioxide** is essential for photosynthesis, the process by which plants make their food.
- **Water vapours** help in rain formation and regulate temperature through heat absorption.
- The **ozone layer**, part of the atmosphere, protects life by absorbing harmful UV radiation from the sun.
- **Nitrogen** is used by plants (after conversion to nitrates) for the formation of proteins and

growth.

- The **atmosphere** also helps in maintaining the Earth's temperature and protecting it from meteors, which burn up upon entering it.
- Thus, the balanced composition of gases ensures a habitable environment for all living organisms.

Q3: Define air pollution. Name the seven major air pollutants and explain their sources and harmful effects.

Air pollution is the presence of harmful substances (solids, liquids, or gases) in the atmosphere that negatively affect human health and the environment.

The seven major air pollutants are:

1. Carbon Dioxide (CO_2):

- **Source**: Burning of fossil fuels.
- **Effect**: Contributes to global warming and climate change.

2. Carbon Monoxide (CO):

- **Source**: Incomplete combustion of fuels in vehicles.
- **Effect**: Poisonous; reduces oxygen carrying capacity of blood.

3. Oxides of Nitrogen (NO, NO_2):

- Source: Vehicle emissions and factories.
- Effect: Causes smog and respiratory issues.

4. Oxides of Sulphur (SO_2, SO_3):

- Source: Burning of coal and oil in power plants.
- Effect: Leads to acid rain and lung diseases.

5. Hydrocarbons (e.g., methane):

- **Source**: Incomplete fuel burning, agriculture, and waste.
- **Effect**: Contribute to smog and greenhouse effect.

6. Particulates (dust, smoke, pollen):

- Source: Construction, industry, and burning.
- Effect: Causes allergies, asthma, and visibility reduction.

7. Ozone (O_3):

- Source: Formed by reaction of NO_x and hydrocarbons in sunlight.
- Effect: Causes respiratory problems and damages plants.

Q4: How are human activities responsible for air pollution? Explain with reference to fossil fuel burning, urbanization, and transportation.

Human activities have significantly increased air pollution due to:

Fossil Fuel Burning:

Burning coal, oil, and gas in power stations, industries, and homes releases CO_2, CO, NO_x, SO_x, and particulates. This is the major cause of air pollution.

Urbanization:

Expansion of cities increases construction activities, solid waste, and energy use, which release pollutants and disturb air quality.

Transportation:

- Millions of vehicles emit carbon monoxide, nitrogen oxides, hydrocarbons, and particulates due to fuel combustion. Older vehicles without emission control systems are even worse.
- Together, these human actions are causing smog, acid rain, climate change, and serious health issues.

Q5: What is smog? How is it formed and what are its effects on human health and the environment?

Smog is a type of air pollution formed by the combination of smoke and fog.

Formation:

- Smog forms when sunlight reacts with pollutants such as nitrogen oxides (NO_x) and hydrocarbons in the atmosphere.
- It is common in winter, especially in urban areas where industrial emissions and vehicle exhaust are high.

- In Pakistan, crop burning, vehicle emissions, and industrial waste are major contributors.

Effects on Human Health:

- Causes eye irritation, throat infection, asthma, lung infections, and breathing difficulties.
- Increases risk of heart and respiratory diseases.

Effects on the Environment:

- Reduces visibility, affecting transportation.
- Inhibits plant growth by blocking sunlight and reducing photosynthesis.
- Damages buildings and monuments.
- Smog is a serious environmental and health issue that requires urgent attention and control measures.

Q6: What is acid rain? How is it formed? Explain the role of sulphur and nitrogen oxides in its formation.

Answer:

- **Acid rain** is a type of rain that has a pH between 4.2 and 4.4, making it more acidic than normal rainwater. It is formed when certain pollutant gases like sulphur dioxide (SO_2) and nitrogen oxides (NO_x) are released into the atmosphere, usually due to human activities like burning fossil fuels (coal, oil, natural gas).
- When SO_2 is released into the air, it can further oxidize to form sulphur trioxide (SO_3).
- Similarly, NO and NO_2 are produced during combustion processes in factories, homes, and vehicles.

These gases react with moisture (water vapours) present in the atmosphere to form acids:

$SO_2 + H_2O \Rightarrow H_2SO_3$ (Sulphurous acid)

$SO_3 + H_2O \Rightarrow H_2SO_4$ (Sulphuric acid)

$NO_2 + H_2O \Rightarrow HNO_3$ (Nitric acid)

These acids mix with rainwater and fall back to Earth as acid rain. Wind can carry these acidic

droplets over long distances before they fall as rain, hail, snow, or fog.

Q7: Describe the process of acid rain formation in the atmosphere. What is the role of moisture and pollutants?

Answer:

The formation of acid rain is a result of pollution caused by human activities, especially the burning of fossil fuels in vehicles, factories, and power plants. When these fuels are burned, they release pollutant gases such as:

1. **Sulphur dioxide (SO_2)**
2. **Nitrogen oxides (NO and NO_2)**

These gases react with moisture (H_2O) in the atmosphere to form acids like sulphuric acid (H_2SO_4) and nitric acid (HNO_3).

These chemical reactions take place:

$SO_2 + O_2 \Rightarrow SO_3$

$SO_3 + H_2O \Rightarrow H_2SO_4$

$2NO_2 + H_2O \Rightarrow HNO_2 + HNO_3$

The moisture in the air (clouds, fog, or vapour) acts as a medium for these chemical reactions. The resulting acids combine with raindrops and fall to the ground as acid rain. This polluted rain affects ecosystems, soils, buildings, and human health.

Q8: What are the harmful effects of acid rain on soil, plants, aquatic life, human health, agriculture, and buildings?

Answer:

Acid rain has widespread harmful effects on the environment and living organisms:

(i) Soil:

Acid rain increases the acidity of the soil, dissolving and washing away essential nutrients like calcium and magnesium. It also releases toxic metals such as aluminium and mercury, which harm plants and organisms in the soil.

(ii) Plants:

It damages vegetation and forests. Many plants cannot survive in acidic soil. Acid rain weakens trees by leaching nutrients from the soil and damaging their leaves, stunting their growth.

(iii) Aquatic Life:

Acid rain falls into rivers, lakes, and ponds, making the water too acidic for fish and other aquatic animals. It disrupts the reproductive systems of aquatic species, leading to a loss of biodiversity.

(iv) Human Health:

While acid rain does not directly affect humans, it releases toxic metals into water sources, which can contaminate drinking water. This leads to health issues such as nervous system damage and respiratory problems.

(v) Agriculture:

Crops are less sensitive than forests but are still affected. Farmers can protect crops by adding lime (CaO) to neutralize the soil. However, long-term exposure reduces soil fertility and crop yield.

(vi) Buildings and Structures:

Acid rain corrodes stone, marble, and metal surfaces. It has damaged many historical monuments like the Taj Mahal and the Parthenon. Acid rain also weakens bridges, railings, and buildings.

Q9: How does acid rain affect forests and aquatic ecosystems?

Answer:

Acid rain has serious consequences for both forests and aquatic ecosystems:

Forests:

- Acid rain causes acidification of soil, removing essential nutrients like potassium, magnesium, and calcium.
- It damages leaves and weakens trees, making them more vulnerable to disease, pests, and extreme weather.
- Roots lose grip in acidic soil, leading to soil

erosion, especially on mountain slopes.

- In areas with continuous acid rain, forests may stop growing altogether or die out.

Aquatic Ecosystems:

- Acid rain enters rivers, lakes, ponds, and wetlands, increasing the acidity of the water.
- Fish and amphibians are highly sensitive to pH changes. Many species cannot survive in water with pH below 5.
- Fish eggs fail to hatch, and adult fish may suffer from reproductive and growth problems.
- Acidic water can also leach toxic metals from the soil into the water, which further harms aquatic life.
- As a result, many lakes become "dead lakes" – lifeless and unable to support aquatic life.

Q9: What is the greenhouse effect? Explain how it leads to global warming.

Answer:

- The greenhouse effect is the warming of Earth's surface due to trapping of heat by greenhouse gases like CO_2, CH_4, and water vapours.
- Sunlight (shortwave radiation) enters the atmosphere and heats the Earth's surface.
- At night, Earth emits longwave radiation (infrared), which is absorbed by greenhouse gases.
- This trapped heat increases Earth's surface temperature, causing global warming.
- The more greenhouse gases there are, the stronger the greenhouse effect becomes.

Q10: Describe the sources of greenhouse gases. How do human activities contribute to global warming?

Answer:

- Burning of fossil fuels (coal, oil, gas) releases CO_2.

- Deforestation reduces trees that absorb CO_2, so more CO_2 stays in the atmosphere.

Methane (CH_4) is released by:

- Decomposition of organic matter
- Animal digestion
- Rice farming
- These gases accumulate in the atmosphere and form a thick layer that traps heat and prevents cooling of the Earth.
- Human activities are directly responsible for this increase.

Q11. What are the harmful effects of global warming? Explain in detail.

1. Rise in Sea Level:

- Ice melting in Antarctica and Greenland
- Expansion of ocean water due to heat
- Threat to coastal areas (e.g., Bangladesh, Netherlands)

2. Increased Rainfall:

- Heavy rainfall in some regions
- May lead to flooding, damaging homes and agriculture

3. Effects on Agriculture:

- Some crops (wheat, rice) may benefit
- Others (maize, sugarcane) may suffer
- Climate changes can reduce food production

4. Hotter Summers & Warmer Winters:

- Seasonal patterns disturbed
- More heatwaves, less snowfall

Q12: How does global warming affect agriculture and human societies?

Answer:

- Changes in temperature and rainfall affect growing seasons.
- Some regions may no longer be able to grow specific crops.

- Droughts or floods may destroy crops.
- This leads to food shortages, price hikes, and economic problems.
- Farmers and rural populations may suffer the most.

Q13:Explain the role of carbon dioxide and methane in the greenhouse effect.

Carbon Dioxide (CO_2):

- Produced by fossil fuel burning
- Absorbs heat and stays in the atmosphere for long periods
- Removed naturally by trees (photosynthesis), but deforestation reduces this

Methane (CH_4):

- Stronger greenhouse gas than CO_2 (absorbs more heat per molecule)
- Comes from rotting plants, animal digestion, and rice fields
- Together, they create a heat-trapping blanket

that warms Earth.

Q14: Explain how air pollution affects human health, especially in high-risk groups.

Air pollution is the presence of harmful substances in the air that we breathe. These pollutants can enter the human body through inhalation and cause serious health problems. People who belong to high-risk groups are more vulnerable to the effects of polluted air.

These groups include:

- Children under the age of 18
- Adults over the age of 65

People with chronic diseases such as asthma, heart disease, or diabetes

Outdoor workers who are exposed to polluted air for longer periods

How Air Pollution Affects Human Health:

1. Respiratory System Damage:

- Polluted air contains harmful gases like carbon

monoxide (CO) and nitrogen oxides (NO_x), as well as particulate matter.

- These pollutants irritate the respiratory tract, leading to coughing, wheezing, and shortness of breath.
- In people with asthma or chronic bronchitis, symptoms can become more severe and frequent.

2. Heart and Blood Circulation Problems:

- Fine particles from the polluted air can enter the bloodstream through the lungs.
- This can cause inflammation in blood vessels, increase blood pressure, and lead to heart attacks or strokes, especially in older adults and those with heart conditions.

3. Impact on the Brain:

- Long-term exposure to air pollution can also affect the brain, possibly contributing to neurodegenerative diseases like Alzheimer's and dementia.

- Poor air quality has been linked to mental stress, reduced cognitive function, and depression.

4. Irritation of Eyes, Nose, and Throat:

- Pollutants like ozone and sulfur dioxide can cause burning sensations in the eyes, runny nose, and sore throat.
- These symptoms may seem mild but can lead to serious infections if the exposure continues.

5. Increased Risk of Cancer:

- Certain air pollutants such as benzene and formaldehyde are carcinogenic.
- Continuous exposure increases the risk of developing lung cancer and other respiratory tract cancers.

6. Premature Death and Hospitalization:

- People in high-risk groups may face serious medical complications.
- Hospital admissions increase during high-pollution days, and in severe cases, air

pollution can lead to premature death.

- Why High-Risk Groups Are More Vulnerable:
- Children have developing lungs, so pollutants affect them more severely.
- Elderly people already have weaker immune and organ systems.
- Patients with chronic illnesses have less resistance against pollutants.
- Outdoor workers face constant exposure to polluted air.

3. Constructed Response Questions

i. How is the excessive use of insecticides and pesticides harmful for birds?

The excessive use of insecticides and pesticides contaminates the environment, especially soil and water. Birds that eat insects or drink contaminated water ingest these toxic chemicals. These substances can:

- Weaken their immune systems
- Cause reproductive issues, such as thinner eggshells leading to egg breakage
- Result in poisoning, illness, or death
- Thus, chemical accumulation in food chains seriously threatens bird populations and biodiversity.

ii. Percentage of CO_2 in air is only 0.04%. Then how does it become harmful for the ecosystem?

Although carbon dioxide (CO_2) makes up just 0.04% of the atmosphere, it is a very effective greenhouse gas. Even a small increase in its concentration can:

- Trap more heat in the atmosphere
- Raise Earth's average temperature (global warming)
- Disrupt climate patterns
- Melt glaciers and raise sea levels
- This harms ecosystems, agriculture, and human health worldwide, showing that even

small amounts can have large-scale environmental impacts.

iii. Why do only some pollutant gases present in the atmosphere cause greenhouse effect while others do not?

Only gases that can absorb and emit infrared (heat) radiation contribute to the greenhouse effect. These include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Water vapour

Other gases like nitrogen (N_2) and oxygen (O_2) cannot absorb this thermal radiation effectively, so they do not trap heat and therefore do not contribute to the greenhouse effect.

iv. How can you reduce the emission of CO present in the gases emitted by the burning of fuel in automobile engines?

To reduce carbon monoxide (CO) emissions from vehicles:

1. Use catalytic converters in exhaust systems to convert CO into less harmful carbon dioxide (CO_2).

2. Maintain engines regularly to ensure complete combustion of fuel.

3. Use clean fuels, such as CNG or electric engines, that produce less CO. These steps improve air quality and reduce health hazards caused by CO.

v. Mention three different ways in which solar energy can be useful for us.

1. **Solar Panels** (Photovoltaic Cells): Convert sunlight directly into electricity for homes, schools, and industries.

2. **Solar Water Heaters**: Use solar heat to warm water for domestic and industrial use.

3. **Solar Cookers**: Use sunlight to cook food without using gas or electricity, saving fuel and reducing pollution.

Solar energy is renewable, eco-friendly, and reduces

dependency on fossil fuels.

4. Descriptive Questions:

i. Describe the harmful effects of the major pollutants present in the air.

Major air pollutants and their harmful effects include:

1. Carbon Monoxide (CO):

It reduces the oxygen-carrying capacity of blood by binding with hemoglobin. This can cause dizziness, fatigue, and in high amounts, even death.

2. Sulphur Dioxide (SO_2):

Causes respiratory problems, such as asthma and bronchitis. It also contributes to acid rain, damaging crops and aquatic life.

3. Nitrogen Oxides (NO_x):

Irritate lungs, reduce lung function, and increase the risk of infections. NO_x gases also lead to the formation of acid rain and smog.

4. Particulate Matter (PM2.5 and PM10):

Fine particles can penetrate deep into lungs and bloodstream, causing heart disease, lung cancer, and other respiratory problems.

5. Ozone (O_3) at ground level:

While protective in the upper atmosphere, ozone near the Earth's surface causes coughing, throat irritation, and worsens lung diseases.

ii. Explain greenhouse effect. How is global warming dangerous for us?

Greenhouse Effect is the trapping of the Sun's heat by gases like CO_2, CH_4, and water vapour in the Earth's atmosphere. These gases allow sunlight in but prevent heat from escaping back into space, warming the planet.

Global Warming, caused by increased greenhouse gases, is dangerous because:

- It melts polar ice, raising sea levels and flooding coastal areas.
- It changes climate patterns, causing droughts,

floods, and storms.

- It damages crops and food supply due to extreme weather.
- It affects human health, spreading heat-related diseases.
- It destroys habitats and leads to extinction of species.

iii. What is air quality index? What information does it convey?

The Air Quality Index (AQI) is a system that rates air quality on a scale. It helps people understand how clean or polluted the air is and whether it poses health risks.

- **AQI under 50**: Good – Air is safe to breathe.
- **AQI 51–100**: Moderate – Acceptable, but may affect sensitive people.
- **AQI 101–200**: Unhealthy for sensitive groups.
- **AQI 201–300**: Very unhealthy – Risk for everyone.

- **AQI above 300**: Hazardous – Serious health effects, avoid outdoor activities.

It helps the public take precautions to protect their health.

iv. Who are high risk groups and why is pollution more dangerous for them?

High-risk groups include:

- Children under 18
- Elderly people over 65
- People with heart or lung diseases
- Diabetics
- Outdoor workers

Pollution is more dangerous for them because:

- Their immune systems are weaker.
- They are more sensitive to pollutants, which can trigger asthma, heart problems, or worsen existing conditions.
- Prolonged exposure can cause serious health issues, hospitalization, or even death in severe

cases.

v. Describe three strategies to address environmental issues.

1. Reduce Fossil Fuel Use:

Shift to renewable energy sources like solar, wind, and hydro power to cut down greenhouse gas emissions.

2. Afforestation and Reforestation:

Planting more trees increases CO_2 absorption, improving air quality and reducing global warming.

3. Promote Public Awareness and Laws:

Educate people about pollution control and enforce environmental protection laws, like emission limits and waste management regulations.

These strategies help create a healthier, sustainable environment for future generations.

Note:

This chapter is designed to provide a solid foundation of knowledge, with the goal of deepening understanding and encouraging further exploration of the subject. The content has been carefully selected to support effective learning and inspire students to engage with the topic more deeply.

Author: Muhammad Asghar

Purpose: To contribute to education by offering insightful, valuable content that enhances learning and understanding.

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