UNIT 10

Environmental Chemistry

Descriptive Questions

Q.1 (Ex. Q.4 (i)) Describe the harmful effects of the major pollutants present in the air. 092010001

Ans. Pollutants and their Harmful Effects

No.	Pollutants	Harmful Effects
i.	Carbon dioxide (CO_2)	Higher levels of carbon dioxide lead to increased global warming which can cause ice caps to melt and oceans to warm, causing sea levels to rise. Extreme weather changes such as heat waves, heavy rains and wild fires also occur.
ii.	Carbon monoxide	It is extremely poisonous gas that can cause suffocation and death. Carbon monoxide is very toxic gas that stops the red blood cells in animal's blood from carrying oxygen that body needs.
iii.	Oxides of nitrogen (NO_x), NO, NO_2	NO_x can damage lungs, irritate the eyes and damage vegetation. It can also cause acid rain which affects buildings and statues made of limestone.
iv.	Oxides of sulphur (SO_x), SO_2, SO_3	SO_x irritates the eyes and causes breathing difficulties and acid rain.
v.	Hydrocarbons	They can cause pneumonia, coughing, many other breathing and lung diseases. They also cause global warming.
vi.	Particulate matter	Irritates the eyes and can also cause severe breathing problems for people with asthma. It also makes clothes dirty. Also, visibility is reduced because it produces haze in the air.
vii.	Ozone	Breathing ozone can cause a variety of health problems including chest pain, coughing, throat irritation and congestion.
viii.	Smog	It can lead to health complications like allergies, asthma and lung infections. Inhibits the proper growth of plants.

Q.2 (Ex. Q.4 (ii)) Explain greenhouse effect. How is global warming dangerous for us? 092010002

Ans. Greenhouse Effect: The process warming up of the Earth's surface due to covering effect of man - made carbon dioxide, methane, water vapours and other gases in the atmosphere is called Greenhouse Effect.

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Phenomenon: The sun emits short wave length radiation (UV) that passes through greenhouse gases to heat the surface of the Earth. At night the hot Earth's surface emits infrared radiation (IR) that is mostly absorbed by green house gases. This process of absorption prevents the radiation to reach space, reducing the speed at which the Earth can cool off. This increases the temperature of the Earth and causes global warming.

Effects of Greeenhouse effect:

i. Rise in Sea-level

Higher temperature will make the water of the seas and oceans expand. Ice melting in the Antarctic and Greenland will flow into the sea and it results in higher sea levels. This phenomenon will threaten the low-lying coastal areas of the world such as the Netherlands and Bangladesh.

ii. Increase in Rainfall

There may be enormous increase in rainfall in a few regions which may increase the sea level. This ultimately will cause worldwide floods endangering survival of living species.

iii. Effects on Agriculture

The changes in the weather will affect the types of crops grown in different parts of the world. Some crops such as wheat and rice grow better in higher temperature but other plants such as maize and sugar cane do not.

iv. Hot summer and winter

In moderate region, the winter will be shorter and warmer and the summer will be longer and hotter.

Q.3 (Ex. Q.4 (iii)) What is air quality index? What information does it convey?

Ans. Air Quality Index 092010003

Definition of AQI: Air quality index(AQI) is a rating system that shows how bad is the atmosphere around you.

Beneficial AQI: An (AQI) value under 50 is considered good in quality. This means that is safe for you to spend time outdoors without posing a risk to your health.

Hazardous AQI: As the (AQI) number increases, so does the risk to health. An (AQI) over 300 is considered hazardous. Children under 18, adults over 65, people with chronic heart or lung disease and diabetic people are high risk groups. Outdoor workers can also be considered at higher risk because of prolonged exposure.

Q.4 (Ex. Q.4 (iv))Who are high risk groups and why is pollution more dangerous for them?

092010004

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heart or lung disease and diabetic people are high risk groups. Outdoor workers can also be considered at higher risk because of prolonged exposure.

Control Measurements:

The following steps should be taken when air quality is bad:

i. Reduced the time you spend outdoors. Also reduce the intensity of outdoor activity. According to experts the chances of being affected by unhealthy atmosphere increase the longer a person is active outdoors and the more laborious the activity.

ii. If you forced to go out then consider wearing a mask. Unfortunately, not all the mask provides adequate safety against particulate matter. Cloth or dust mask may not effectively filter out the finer particles. However, well fitted N95 masks have better filtration capabilities and may be safer to use.

iii. Keep your indoor healthy by keeping the windows and doors closed. If it is difficult to maintain clean air in the entire room, then create a clean room by switching on air conditioner or air cleaner.

iv. If you experience such symptoms that worry you, talk to your doctor.

v. Install carbon monoxide detector to detect the increased level of carbon monoxide. These higher levels of CO may occur due to faulty fuel burning appliances.

Effects: Breathing in polluted air by these high risk groups may affect their lungs, heart and brain. Air pollutants can enter their blood stream and can cause coughing or itching of eyes which may lead to poor quality of life hospitalization, cancer or even premature death.

Q.5 (Ex. Q.4 (v)) Describe three strategies to address environmental issues. 092010005

Ans. Huge amount of pollutant gases are thrown out in the atmosphere by burning fossil fuels. Automobiles, aeroplanes, industrial machines and coal-fired electricity generating plants, etc. are mainly responsible for the extremely polluted air especially in big cities. Scientists have developed a number of different ways to control this menace of pollution.

i. Tree Plantation

Planting trees is thought to be very helpful in removing the air pollution. A well-known process carried out by plants is photosynthesis in which plants clean the air through absorption of carbon dioxide and releasing oxygen. This famous reaction takes place in the presence of sunlight and it is catalyzed by chlorophyll, the green pigments present in leaves.

$$6\,CO_{2(g)} + 6H_2O_{(l)} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_{6(s)} + 6O_{2(g)}$$

The particulate matter present in the atmosphere is also removed by plants when it deposits on leaves, branches and trunk surfaces.

ii. Catalytic Converters

Catalytic converters are used in the exhaust system of modern-day automobiles to reduce the emissions from an internal combustion engine. Due to non-availability of enough oxygen the carbon fuel in engine does not burn completely into carbon

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dioxide and water. Thus, toxic by-products like CO and hydrocarbons are produced.

A three-way catalytic converter performed the following three functions simultaneously.

1. It reduces nitrogen oxides into elemental nitrogen and oxygen.

$$2NO_{x(g)} \longrightarrow N_{2(g)} + xO_{2(g)}$$

2. It oxidizes CO to CO_2

$$2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$$

3. It oxidizes hydrocarbons into CO_2 and H_2O

$$C_xH_{2x+2(g)} + 2O_{2(g)} \longrightarrow X\ CO_{2(g)} + 2H_2O_{(l)}$$

iii. Flue gas desulphurization process

The emission of sulphur dioxide can be decreased either by using fuels which have significantly less sulphur contents or using flue gas desulphurization process. This process can remove sulphur dioxide gas from the exhaust gases of fossil fuel. Flue gas is the mixture of waste gases produced when fossil fuels are burnt in power plants. The desulphurization process involves the addition of adsorbents like calcium oxide which can remove upto 95% of the sulphur dioxide from the flue gas.

iv. Use of harmless renewable resources

To discourage the excessive use of fossil fuels in our daily lives it is urgently required to use the renewable resources to meet our energy needs. Renewable resources are those resources that can continue to exist despite being consumed over a period of time even as they are used.

Investigative Questions

Q.1. (Ex. Q.5 (i)) Major Pakistani cities experience a very high AQI in winter which renders them along the most polluted cities in the world point out some of the major causes of high AQI in these cities. 092010006

Ans. Air Quality Index :

Air quality index (AQI) is a rating system that shows how bad is the atmosphere around you. An AQI below 50 is considered good in quality, meaning it is safe for you to spend time outdoor without posing a risk to your health. As the AQI number increases, so does the risk to health.

Quality Rating	Considerations
0 – 50	Good
51 – 100	Moderate
101 – 150	Unhealthy for sensitive group
151 – 200	Unhealthy
201 – 300	Very unhealthy
301 +	Hazardous

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High Risk Group

An AQI over 300 is considered as hazardous. Children under 18, adults over 65, people with chronic heart or lung disease and diabetic individuals are considering high risk group. Outdoor workers can also be considered at higher risk because of prolonged exposure

Effects of Hazardous AQI

Breathing polluted air can effect the lungs, heart and brain. Air pollutant can enter their blood stream and can cause coughing or itching of eyes which may lead to poor quality of life, hospitalization, cancer or even premature death

Major causes of high AQI

High AQI is due to following factors

i. **Crop Burning**
   Farmers burn their crops in fields after harvesting. They burn the crop residues to make land prepare for next crop.

ii. **Fossil fuel Burning**
   Fossil fuels like petroleum products, coal, natural gas etc. are burnt to get energy for transportation, heat and electricity generation

iii. **Destruction of Green-Land area:**
   Concrete structures has been installed in place of green land area Decrease in number of plants increase AQI.

iv. **Industrial emission**
   Smoke coming from chimneys of industries is playing a major role for bad AQI.

Q.2. (Ex. Q.5 (ii)) Why does AQI not rise in Pakistan in hot days of summer? 092010007

Ans. The air quality index (AQI) in Pakistan often remain moderate during hot summer days due to following reasons.

i. **High Temperature**
   High temperature creates surface heating resulting in mixing up of layers of air. This mix up dilute air pollutants in atmosphere.

ii. **Reduced Photochemical Reactions**
   Hot summer reduces the precursor of photochemical reactions like volatile organic compounds and nitrogen oxides (NO_x). They cannot combine helping in less ozone formation

iii. **Low Humidity**
   Low humidity in many regions decreases formation of secondary aerosols (major component of particulate matter)

iv. **Wind Pattern**
   Hot weather often brings strong winds in plain areas. These winds disperse transport pollutants away from urban center.

v. **Chemical Kinetics of pollutant**
   Dry and windy conditions due to reduced moisture render formation of secondary pollutants

Q.3. (Ex. Q.5 (iii)) How has climate change affected Pakistan during the last five years? 092010008

Ans. Climate change has significantly impacted Pakistan over last five years causing environment, economic and agriculture losses. Following are effects of climate change.

i. **Heatwaves**

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Pakistan experienced record breaking heatwave since last five years. Temperature exceeds 50 °C in some areas of Pakistan.

ii. Rise in sea level

High temperature will make water of seas and oceans expand. Ice melting in Antarctic and Greenland will flow into sea and it result in higher sea level. This phenomenon will threaten low lying coastal areas of Pakistan.

iii. Increase in Rainfall

There may be sufficient increase in rainfall in a few regions that may increase sea level. This ultimately will cause worldwide flood endangering survival of living species.

iv. Effects on agriculture

It will affect type of crops grown in different parts of Pakistan. Some crops such as wheat and rice grow better in higher temperature but other like maize and sugarcane do not.

SLO Based Additional Long Question

Q.1. Write the sources of Air Pollutants. 092010009

Ans. i. Human activities

Millions of tonnes of pollutants are emitted into the atmosphere each year as a result of human activities. The major activity among them is the completed and incomplete combustion of fossils fuels which along is responsible for most of our pollution problem.

ii. Combustion

Burning of fossil fuels (oil natural gas, coal) produce carbon dioxide carbon monoxide, NO_x, SO_x, CH_4, ash, smoked and suspended particles. Many of these pollutants are also released into the air by natural process e.g. volcanic eruption releases large quantities of CO_2, SO_2 and particulates. Methane is released in the air by the decomposition of vegetation. It is also present in waste gases produced during digestion in animals.

iii. Over Population

Rapid growth of population, urbanization, industrialization and transportation are the main factors which are responsible for environmental pollution. All these factors are increasing in every city of the world especially in the last half century. These pollutants are affecting the environment very badly.

iv. Ozone

Another pollutant ozone (O_3) is formed when heat and sunlight cause chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (hydrocarbons).

Q.2. Define acid rain & how is it formed? 092010010

Acid Rain and its Effects

Ans. Definition

When rain water has pH less than 5.6, it is known as acid rain.

Historical Background

In 1852, Robert Angus Smith was the first to show the relationship between acid rain and atmospheric pollution in Manchester, England. He is sometimes referred to as the "Father of Acid Rain.

Causes

Burning of fossil fuels releases harmful gases into the atmosphere. These gases (SO_2,SO_3) are produced due to the presence of sulphur in the fossil fuels. SO_2 is converted to SO_3 in the presence of oxides of nitrogen of the atmosphere. Oxides of nitrogen are produced mostly by the direct combination of atmospheric oxygen and nitrogen in the industrial and domestic combustion processes. They are also produced by the combustion of atmospheric nitrogen and oxygen in the presence of lightning. Significant amount of nitrogen oxides is produced by the reactions taking place in automobile engines.

Formation: These gases mix with the moisture that is always present in the air to form acid droplets. Wind can carry these acidic droplets to huge distance.

Finally, these droplets return to the ground as acid rain, acid hail, snow and even fog. Acid rain looks, feels and testes like clean rain. Its corrosive nature causes widespread damage to the environment.

$$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$$
$$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)}$$
$$SO_{3(g)} + H_2O_{(l)} \longrightarrow H_2SO_{4(aq)}$$
$$N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)}$$
$$2NO_{(g)} + O_{2(g)} \longrightarrow 2NO_{2(g)}$$
$$2NO_{2(g)} + H_2O_{(l)} \longrightarrow HNO_{3(g)} + HNO_{2(g)}$$

Q.3. What are the effects of Acid Rain? 092010011

Ans. Effects of Acid Rain

Acid rain causes a number of adverse effects. It tends to increase acidity of the soil, threatens human and aquatic life, destroy forests and reduces agricultural productivity. Besides it can corrode building, monuments, statues, bridges and railings. Most important adverse effects of acid rain are as follows:

i. Soil

Acid rain makes soil more acidic. It dissolves and washes away nutrients present in the soil which are needed by plants. It can also dissolve toxic substances such as aluminium and mercury which are naturally present in the soil.

ii. Plants

Many plants cannot live or grow in acidic soil. It can damage vegetation and plants. Tree roots hold the soil together on hills and mountain areas. If the trees are destroyed, then the soil is washed away and new plants cannot grow there.

iii. Aquatic Life

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Acid rain falls into drains streams, lakes, marshes, rivers and damages the aquatic life. Acid rain can make water too acidic for animals to live in. Due to this, many lakes and rivers no longer have fish.

iv. Human Health

The acidification of surface water does not affect life directly. However, toxic substances leached from the soil can pollute land water supplies and damage human health.

v. Agriculture

Crops are less affected by the acid rain than forest. Farmers can prevent acid rain damage by monitoring the conditions of the soil and when necessary adding crushed lime to neutralize the acid.

vi. Human-made Structure

Acid rain and the dry deposition of acidic particles damage buildings, statues, automobiles and other structures made of stone, metal etc. Historical buildings like Parthenon in Athens (Greece) and the Taj Mahal in Agra (India) are deteriorating due to acid rain.

Exercise Short Question

Q.1 What is the main objective of environmental education? Importance of environmental education. 092010012

Ans. Environmental chemistry is a part of environmental education. The objective of which is to enlighten the people particularly the students, about the importance of protection and conservation of our environment.

Increasing use of fossil fuels (natural gas, coal and petroleum) have polluted the atmosphere upto such an extent that it is difficult to breathe air in some areas of metropolitan cities.

Q.2 How is particulate matter released in the atmosphere? 092010013

Ans. Burning of fossils fuels (oil, natural gas, coal). Volcanic eruption, decomposition of vegetation, rapid growth of populations urbanization, industrialization and transportation are the main factors to release particulate matter in atmosphere.

Q.3 Which gas is more poisonous, CO_2 or CO? 092010014

Ans. CO is poisonous gas because it bind to heamoglobin in blood. It hinders the supply of O_2 in all parts of body and ultimately causes suffocation and death of or organism.

Q.4 How does acid rain affect forests? 092010015

Ans. Acid rain can damage vegetation and plants. Many plants cannot live or grow in acidic soil. Tree roots hold the soil together on hills and mountain areas. If the trees are destroyed then the soil is washed way and new plants cannot grow there.

Q.5 In what way Sulphur present in fossil fuels becomes dangerous? 092010016

Ans. When Sulphur containing fossils fuels are burned oxides of Sulphur (SO_x), SO_2, SO_3 are produced.

SO_x irritates the eyes and causes breathing difficulties and acid rain.

$$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$$

$$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)}$$

$$SO_{3(g)} + H_2O_{(g)} \longrightarrow H_2SO_{4(aq)}$$

Q.6 Name any three major sources responsible for the greenhouse effect. 092010017

Ans. Methane(CH_4), carbon dioxide (CO_2) and Nitrous oxide (N_2O) and water

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vapors produced due to burning of fossils fuels.

Q.7 How is geothermal energy useful for us? 092010018

Ans. Geothermal energy is useful for us because it provides a renewable and sustainable source of energy. It can be used for electricity generation, heating buildings and supplying hot water. It is environmental friendly.

Practice Exercise Questions

Q.8 Which method is used to separate gases present in the air? 092010019

Ans. The process used to separate gases present in air is fractional distillation. In this process first air is cooled to liquefy it and then it is slowly warmed to boil gases at their boiling temperatures. Vapors of each gas are collected separately.

Q.9 Which gas is released when fizzy drinks open? 092010020

Ans. CO_2 gas is released when carbonated drinks are opened.

Q.10 How does air pollution affect plants? 092010021

Ans. Air pollutant like ozone, SO_2, NO_2, etc inhibits the growth of plants by reducing the amount of carbon dioxide absorbed during photosynthesis and reduce crops yield.

Q.11 Which acids are made when SO_2 and NO_2 dissolve in rain? 092010022

Ans. Sulphuric acid (H_2SO_4) and nitric acid (HNO_3) are made when SO_2 and NO_2 dissolve in rain respectively.

$$NO_{2(g)} + H_2O_{(g)} \longrightarrow HNO_{3(l)}$$

$$SO_{3(g)} + H_2O_{(g)} \longrightarrow H_2SO_{4(aq)}$$

Q.12 What happens to the soil if trees are destroyed by acid rain? 092010023

Ans. Tree roots hold the soil together on bills and mountain areas. If the trees are destroyed, then the soil is washed away and new plants cannot grow there.

Q.13 How do living things add and plants remove carbon dioxide from the air? 092010024

Ans. Living things like Humans and animals inhale O_2 from the air and exhale CO_2 in to the air during respiration.

White plants consume CO_2 from the air during photosynthesis.

In this way living things add and plants remove CO_2 from the air.

Q.14 Which gas do rice plants produce? 092010025

Ans. Rice plants produce oxygen as a by product of photosynthesis and methane (CH_4) throw methaeogenesis.

Q.15 Which gas is given out by rotting garbage? 092010026

Ans. Methane gas (CH_4) is produced during rotting of garbage.

SLO Based Additional Short Question

Composition of Atmosphere

Q.16 What do you mean by atmosphere? 092010027

Ans. Atmosphere is the envelope of different gases around the Earth.

Q.17 What is environmental chemistry? 092010028

Ans. The branch of chemistry which deals with the study of chemicals and other pollutants in the environment is called environmental chemistry.

Q.18 Why environmental science is important for us?

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Ans. Environmental science helps us to understand the complex interaction that occur in our ecosystem and the impacts on human life.

Q.19 What is the difference between atmosphere and environment? 092010029

Ans. Atmosphere: Atmosphere is the envelope of different gases around the Earth.

Environment: Environment is the sum of all social, biological, physical and chemical factors which constitutes the surroundings of living things.

Q.20 Write composition of dry air. 092010030

Ans. Composition of dry air

Major Constituent	Percentage	Minor Constituent	Percentage
Nitrogen	78.0	Carbon dioxide	0.03
Oxygen	21.0	Noble gases	About 1.0
		Water Vapours	Variable

Air Pollutants

Q.21 What is the difference between a pollutant and contaminant? 092010031

Ans. Pollutants are those substances which cause pollution while **contaminants** are those substances that make something impure.

Q.22 What are air pollutants? 092010032

Ans. Any substance (solid, liquid, or gas) in the air which has adverse effect on human health, quality of life and natural functioning of ecosystem is called an air pollutant.

It has two types, primary pollutants and secondary pollutants.

Q.23 How are sulphur containing compounds emitted naturally? 092010033

Ans. Naturally sulphur compounds are emitted in bacterial decay of organic matter, in volcanic gases and forest fires.

Q.24 Comment: burning in open air is preferred. 092010034

Ans. In open air burning produces CO_2 gas which becomes part of atmosphere. CO_2 is not a poisonous gas. Whereas in closed places CO is produced due to limited supply of oxygen. CO is poisonous gas and can be fatal. That's why burning in open air is preferred.

Q.25 CO is a hidden enemy. Explain its action. OR (How is CO considered a health hazard?) 092010035

Ans. CO is poisonous gas. Being colourless and odourless its presence can be noticed easily and readily. It binds with haemoglobin. So, supply of oxygen is cut off. If inhaled for a longer time, it causes breathing difficulty which leads to death.

Q.26 State the major sources of CO and CO_2 emission. (Write down the sources of oxides of carbon). 092010036

Ans. Sources of CO and CO_2 Emission:

i. Both of these gases are emitted due to volcanic eruption and decomposition of organic matter naturally.

ii. The major source for the emission of these gases is combustion of fossil fuels (coal, petroleum and natural gas). Fossil fuels burnt in combustion engine of any type of automobile, kiln of any industry, or open air fires emit CO_2 and CO.

Q.27 Write down the physical properties, sources and effects of oxides of nitrogen. 092010037

Ans. Physical properties: NO is colourless, odourless gas soluble in water. NO_2 is reddish brown gas with pungent

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odour soluble in water. Both are highly toxic gases.

Sources: Exhaust fumes of motor vehicles, power stations and industries using fossil fuels.

Harmful effects: Cough, headaches lung diseases, acid rain and greenhouse effect (global warming).

Acid Rain

Q.28 How many tons of garbage spread over in the Pacific Ocean? 092010038

Ans. There is a giant floating patch of garbage spread over the Pacific Ocean. It contains about 100 million tons of garbage.

Q.29 How is acid rain produced? 092010039

Ans. Acid rain means presence of excessive acids in rain water. This rain is produced when normal rain water dissolves oxides of sulphur and nitrogen in air. Rain water converts SO_2 into H_2SO_4 and NO_x to HNO_2 and HNO_3. These acids reduce the pH of rain water upto 4. Thus acid rain is formed on dissolving acidic air pollutants such as SO_2 and NO_2 in rain water.

Q.30 How is aquatic life affected by acid rain? / How aluminium harm the fish? 092010040

Ans. Acid rain on soil and rocks leaches heavy metlas (Al, Hg, Pb, Cr, etc.) with it and discharges these metals into rivers and lakes. Aquatic life present in lakes suffers because of high concentration of these metals. Especially high concentration of aluminium metal clogs the fish gills. It causes suffocation and ultimately death of fish.

Q.31 Why are plants dying day by day? Comment. 092010041

Ans. Acid rain directly damages the leaves of trees and plants, thus limiting their growth. Depending upon the severity of the damage, plants growth can be hampered. Plants ability to bear cold or diseases reduces and they ultimately die.

Q.32 What are the strategies to reduce or control the acid rain? 092010042

Ans. Acid rain mitigation:

a) **Emission control:** Measures to reduce emissions of sulfur dioxide, nitrogen oxides from industrial units, power plants, and vehicles are important for reducing acid rain. This can be achieved through the introduction of anti-pollution technologies and the use of cleaner fuels.

b) **Low sulphur fuels:** Promoting low sulphur fuels can also minimize the amount of sulphuric acid in the atmosphere that causes acid rain.

Global Warming (Greenhouse Effect)

Q.33 How is the temperature of atmosphere maintained? 092010043

Ans. CO_2 and water vapours maintain temperature of atmosphere. These gases absorb much of infrared radiations coming from Earth surface and warm the atmosphere.

Q.34 CO_2 is responsible for heating up atmosphere. How? What do you mean by Green House effect? 092010044

Ans. CO_2 is greenhouse gas. In atmosphere it acts like a glass wall of greenhouse. It absorbs infrared radiations and allows visible light to pass through. So, it absorbs most of outgoing radiations which result in heating of atmosphere. This is called Greenhouse effect.

Q.35 What do you mean by greenhouse effect? 092010045

Ans. CO_2 layer acts like an envelope around the earth. It absorbs infrared radiations emitted by the Earths' surface and helps to keep it warm at night. Increased

concentration of CO_2 increases the average temperature of the earth surface gradually. This is called greenhouse effect.

Q.36 Define global warming. 092010046

Ans. Global warming is rising of temperature because of trapping of heat energy by carbon dioxide gas in the atmosphere.

Q.37 Why are the flood risks increasing? 092010047

Ans. Increasing in the temperature of the earth due to Global warming melts glaciers and snow caps that are increasing flood risk.

Q.38 What are the global effects of pollution? 092010048

Ans. Greenhouse effect, depletion of ozone and acid rain are the global effect of pollution.

Q.39 What are the sources of Greenhouse gases? 092010049

Ans. Due to burning of the large amount of coal, oil and natural gas, the amount of greenhouse gases, carbon dioxide together with other gases in the atmosphere has increased for the last 300 years. About half of this carbon dioxide is utilized by plant life during photosynthesis. As human being cut down forests, the capacity of the trees to remove CO_2 from the air is diminished. Methane is another greenhouse gas which causes adverse effects. The increase in its concentration in air is due to the increased decay of vegetation matter, digestion in animals and increased farming of the rice fields.

Q.40 Why water vapors are dangerous for as? 092010050

Ans. Water vapours also act as greenhouse gas. When released into the atmosphere, water soon comes back to earth as acid rain.

Strategies to Reduce Environmental Issues

solar energy and wind energy have been proved to be very effective ways of

Q.41 What are catalytic convertors write their advantages? 092010051

Ans. Catalytic converters are used in the exhaust system of modern-day automobiles to reduce the emissions from an internal combustion engine. Due to non-availability of enough oxygen the carbon fuel in engine does not burn completely into carbon dioxide and water. Thus, toxic byproducts like CO and hydrocarbons are produced.

Advantages;

A three-way catalytic inverter performed the following three functions simultaneously.

i. It reduces nitrogen oxide into elemental nitrogen and oxygen.

$$NO_{x(g)} \qquad N_{2(g)} + O_{2(g)}$$

ii. It oxidizes CO to CO_2

$$2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)} + O_{2(g)}$$

iii. It oxidizes hydrocarbons into CO_2 and H_2O

$$C_xH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(\ell)}$$

Q.42 How can high emission of SO_2 be controlled? 092010052

Ans. The emission of sulphur dioxide can be decreased either by using fuels which have significantly less sulphur contents or using flue gas desulphurization process. This process can remove sulphur dioxide gas from the exhaust gases of fossil fuel. Flue gas is the emitted material produced when fossil fuels are burnt in power plants. The desulphurization process involves the addition of absorbents like calcium oxide which can remove upto 95% of the sulphur dioxide from the flue gas.

Q.43 What are renewable resources? 092010053

Ans. Renewable resources are those resources than cat continue to exist despite being consumed over a period of time even as they are used.

These resources include Sun, wind, water, geothermal, biomass and hydrogen gas, generating electricity without damaging the environment.

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Constructed Response Questions

Q.1 (Ex. Q.3 (i)) How is the excessive use of insecticides and pesticides harmful for birds? 092010054

Ans. Excessive pesticide and insecticide use harms birds through direct poisoning food chain, contamination, habitat disruption and reproductive issues.

Q.2 (Ex. Q.3 (ii)) Percentage of CO_2 in air is only 0.03%. Then how does it become harmful for the ecosystem? 092010055

Ans. The carbon dioxide which is not utilized in photosynthesis goes on accumulating in the lower areas of the atmosphere and forms a thick dense layer. This layer behaves like glass sheet of greenhouse that allows the incoming solar radiation but does not allow it to escape outside; as a result of this the average temperature of the Earth rises.

Q.3 (Ex. Q.3 (iii)) Why only some pollutant gases present in the atmosphere cause green house effect while others do not? 092010056

Ans. Greenhouse gases absorb and emit infrared radiation due to their structure and vibrational properties. Other pollutant does not have such characters thats why they are not termed as greenhouse gases.

Q.4 (Ex. Q.3 (iv)) How can you reduce the emission of CO present in the gases emitted by the burning of fuel in the automobile engines? 092010057

Ans. Catalytic converters are used in the exhaust system of modern-day automobiles to reduce the emissions from an internal combustion engine. Due to non-availability of enough oxygen the carbon fuel in engine does not burn completely into carbon dioxide and water. Thus, toxic by-products like CO and hydrocarbons are produced.

It oxidizes CO to CO_2

$$2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)}$$

Q.5 (Ex. Q.3 (v)) Mention three different ways in which solar energy can be useful for us. 092010058

Ans. Solar energy can be helpful for us in electricity generation, solar water heating and solar drying and agriculture application.

Multiple Choice Questions (Exercise)

1. **Which gases are responsible for greenhouse effect?** 092010059
   (a) SO_x, NO_x (b) NO_2, CO
   (c) CO, CH_4 (d) O_2, N_2
2. **Indicate the source of sulphur which is responsible for the presence of oxides of sulphur in the atmosphere.** 092010060
   (a) Decomposition of vegetation
   (b) Waste gases from digestion of animals
   (c) Photochemical smog
   (d) Combustion of fossil fuels
3. **Concentration of which gas in the atmosphere is decreased by photosynthesis in plants?** 092010061
   (a) Oxygen (c) Carbon dioxide
   (b) Nitrogen (d) Water vapours
4. **Which substance remains unaffected in the catalytic converter fixed in the exhaust of the automobiles?** 092010062
   (a) CO_2 (b) CO
   (c) NO (d) NO_2
5. **People of which age groups are most affected by the air pollution?** 092010063
   (a) Young adults
   (b) Cancer Patient
   (c) Children
   (d) Both children and aged people

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6. **In which area there is a greater possibility of acid rain?** 092010064
   (a) Around village
   (b) Around big cities
   (c) Around industrial area
   (d) Around water bodies
7. **Why is smog not felt in summer?** 092010065
   (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
8. **Which catalyst is used in the catalytic converter fixed in the exhaust systems of automobiles?** 092010066
   (a) Ni (b) Cu
   (c) Pt, Pd and Rh (d) CaO
9. **Which components are essential for the formation of photochemical smog?** 092010067
   (a) CO, NO_2, CO_2
   (b) NO_2, volatile organic compounds, sunlight
   (c) CO_2, NO_2, sunlight
   (d) Volatile organic compounds, NO_2,CO
10. **Which gases contribute towards the formation of acid rain?** 092010068
    (a) Oxides of carbon
    (b) Oxides of sulphur
    (c) Oxides of nitrogen
    (d) Oxides of Both the oxides of nitrogen and sulfur

SLO's Based Additional MCQ's

Composition of Atmosphere

11. **% age of oxygen gas by volume in dry air is:** 092010069
    (a) 90% (b) 21%
    (c) 30.94% (d) 40%
12. **99% of atmosphere consists of:** 092010070
    (a) N_2 and H_2 (b) N_2 and O_2
    (c) N_2 and CO_2 (d) O_2 and CO_2
13. **The envelope of different gases around the Earth is called:** 092010071
    (a) atmosphere (b) biosphere
    (c) lithosphere (d) hydrosphere
14. **The percentage by volume of nitrogen in dry air is:** 092010072
    (a) 78% (b) 20.94%
    (c) 0.93% (d) 0.03%

Air Pollutants

15. **Which one of these pollutants are not found in car exhaust fumes?** 092010073
    (a) CO (b) O_3
    (c) NO_2 (d) SO_2
16. **Carbon monoxide is harmful to us because:** 092010074
    (a) it paralyses the lungs
    (b) it damages lungs tissues
    (c) it reduces oxygen carrying ability of haemoglobin
    (d) it makes the blood coagulate
17. **The percentage of SO_2 released by the combustion of coal and petroleum products is:** 092010075
    (a) 40% (b) 60%
    (c) 70% (d) 80%
18. **Which is not a characteristic of SO_2?** 092010076
    (a) it is colourless gas
    (b) it has irritating smell
    (c) it causes suffocation
    (d) it does not form sulphuric acid
19. **How many % of marine mammals are at the risk of choking on plastic?** 092010077
    (a) 21% (b) 0.03%
    (c) 78% (d) 99%
20. **How many percentage of all available water use by humans?** 092010078
    (a) 1% (b) 2%
    (c) 3% (d) 4%

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21. **Which gas is produced by the electrical lightning in air?** 092010079
(a) NO (b) SO_2
(c) SO_3 (d) CO_2

22. **Which is not an air pollutant?** 092010080
(a) CO_2 (b) SO_2
(c) CO (d) NH_3

23. **Which is not a poisonous gas?** 092010081
(a) Ozone (b) CO
(c) Carbon dioxide (d) All of these

24. **Higher concentration of CO causes?** 092010082
(a) Fatigue (b) Headache
(c) Breathing difficulties (d) All of these

25. **A pollutant is a waste material that pollutes:** 092010083
(a) air (b) water
(c) soil (d) all of these

26. **Which factor determines the severity of a pollutant?** 092010084
(a) chemical nature
(b) concentration
(c) persistence
(d) all of the above

27. **Which of the following is a poisonous gas?** 092010085
(a) oxygen (b) ozone
(c) nitrogen (d) carbon dioxide

28. **Which gas is emitted due to volcanic eruption?** 092010086
(a) CO_2 (b) SO_2
(c) N_2 (d) Both a & b

Acid Rains

29. **Normally rain water is weakly acidic because of:** 092010087
(a) SO_3 gas (b) CO_2 gas
(c) SO_2 gas (d) NO_2 gas

30. **Buildings are being damaged by acid rain because it attacks:** 092010088
(a) calcium sulphate
(b) calcium nitrate
(c) calcium carbonate
(d) calcium oxalate

31. **The pH of normal rain water is:** 092010089
(a) 4–6
(b) 5–6
(c) 6–7
(d) 7–8

Global Warming (Greenhouse Effect)

32. **A group of gases that maintains temperature of atmosphere is:** 092010090
(a) carbon dioxide and water vapours
(b) nitrogen and carbon dioxide
(c) oxygen and water vapours
(d) nitrogen and oxygen

33. **The Earth's atmosphere is getting hotter because of:** 092010091
(a) increasing concentration of CO
(b) increasing concentration of CO_2
(c) increasing concentration of O_3
(d) increasing concentration of SO_2

34. **Which one of the following is not a greenhouse effect?** 092010092
(a) increasing atmospheric temperature
(b) increasing food chains
(c) increasing flood risks
(d) increasing sea-level

35. **Global warming causes rising of the sea level. The cause of global warming is:** 092010093
(a) CO_2 gas (b) SO_2 gas
(c) NO_X gases (d) O_3 gas

36. **Global warming is because of:** 092010094
(a) Absorption of infrared radiations emitted by Earth's surface
(b) Absorption of infrared radiations coming from the sun
(c) Absorption of ultraviolet radiations coming from the sun
(d) Emission of ultraviolet radiations from the Earth's surface

37. **Which gas is responsible for warming the atmosphere?** 092010095
(a) nitrogen (b) hydrogen
(c) helium (d) carbon dioxide

38. **Which gas in atmosphere acts as a glass wall of a green house?** 092010096

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(a) oxygen
(b) carbon dioxide
(c) sulphur dioxide
(d) hydrogen

39. Increased concentration of CO_2 in air, results: 092010097
(a) decreasing temperature
(b) increasing temperature
(c) temperature remain same
(d) none of the above

40. Which type of pollutants are responsible for changing weather? 092010098
(a) air pollutants
(b) water pollutants
(c) soil pollutants
(d) all of the above

41. Fossil fuel means: 092010099
(a) coal
(b) petroleum
(c) natural gas
(d) all of these

42. Forest fires and burning of wood emit: 092010100
(a) CO_2
(b) O_2
(c) N_2
(d) Cl_2

43. How many tree are there in the world? 092010101
(a) 3.21 trillion
(b) 3.04 trillion
(c) 3.21 million
(d) 3.04 million

44. How many trees are cut down t make toilet paper every day? 092010102
(a) 2000
(b) 2200
(c) 2700
(d) 27000

45. How many tons of ice have lost sinc 1990? 092010103
(a) 28 trillion
(b) 18 trillion
(c) 10 trillion
(d) 8 trillion

46. How many tons of ice melts every year? 092010104
(a) 1.2 trillion
(b) 2.2 trillion
(c) 0.2 trillion
(d) 3.2 trillion

Strategies to Reduce Environmental Issues

47. Catalytic converters convert: 092010105
(a) CO to CO_2
(b) N_2 to NO
(c) CO_2 to CO
(d) N_2 to NO_2

48. Which gas is also known as life gas for plants? 092010106
(a) CO
(b) O_2
(c) CO_2
(d) NO_2

49. In the bacterial decay, the compounds of which element are emitted? 092010107
(a) Sulphur
(b) phosphorus
(c) iodine
(d) all of the above

Answer Key

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

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