Subject: Chemistry	**Chapter:** Unit 11
Class: 9th	**Teacher:** Javaid Iqbal
School: Innovative Higher Secondary School	

FBISE SLO-Aligned Question & Answer Set

Short Questions (3 Marks Each)

1. What is Global Warming? Write its effects.

Global warming is the gradual increase in the Earth's average temperature due to higher concentrations of greenhouse gases, such as carbon dioxide (CO_2) and methane (CH_4), in the atmosphere.
Effects:
1. Climate change, including unpredictable weather patterns.
2. Melting of glaciers and rise in sea levels.
3. Increased frequency of heatwaves and droughts.

2. Write importance of Catalytic Converters in Vehicles.

Catalytic converters are devices installed in vehicle exhaust systems to reduce harmful emissions.
- They convert carbon monoxide (CO) into carbon dioxide (CO_2), and oxides of nitrogen (NO, NO_2) into nitrogen gas (N_2), reducing air pollution and acid rain.
Example reaction:
$CO + 2NO \rightarrow 2CO_2 + N_2$

3. Discuss any two risk factors of Pollution.

1. Long-term exposure to polluted air — can cause chronic respiratory diseases like asthma and bronchitis.
2. Living near industrial zones or busy roads — increases the risk of heart and lung problems due to high pollutant concentration.

4. Describe any two personal protective measures against pollution.

1. Use of masks to reduce inhalation of harmful particulates.
2. Monitoring air quality index (AQI) and avoiding outdoor activities when pollution levels are high.

5. Briefly describe what is photosynthesis?

Photosynthesis is the process by which green plants use chlorophyll and sunlight to convert carbon dioxide and water into glucose and oxygen.
Equation:
$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (in presence of light and chlorophyll)

6. What is Acid Rain? Write some harmful effects of acid rain on iron and marble buildings.

Acid rain is rainwater with a pH lower than 5.6, formed when sulfur dioxide (SO_2) and nitrogen oxides (NO, NO_2) react with water in the atmosphere to form acids.
Effects:
- On iron: Causes rusting.
$4Fe + 6H_2O + 3O_2 \rightarrow 4Fe(OH)_3$
- On marble ($CaCO_3$): Corrodes surface.
$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

7. Describe the composition of air.

Clean, dry air contains approximately:
- 78% Nitrogen (N_2)
- 21% Oxygen (O_2)
- 1% mixture of noble gases and carbon dioxide (CO_2)
- Little water vapors upto 4% on air over tropical rain forests.

8. Write role of Sulphur in acid rain formation.

Sulfur in fossil fuels burns to produce sulfur dioxide (SO_2), which oxidizes to sulfur trioxide (SO_3) and reacts with water to form sulfuric acid (H_2SO_4).

$S + O_2 \rightarrow SO_2$

$2SO_2 + O_2 \rightarrow 2SO_3$

$SO_3 + H_2O \rightarrow H_2SO_4$

9. Briefly describe the role of NO and NO_2 in the formation of acid rain.

Oxides of nitrogen (NO, NO_2) from car engines react with water to form nitric acid (HNO_3). They also catalyze the oxidation of SO_2 to SO_3.

$2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$

$NO_2 + SO_2 \rightarrow SO_3 + NO$

Long Questions (6 Marks Each)

1. Describe sources of some major air pollutants.

- Carbon dioxide (CO_2): Complete combustion of carbon-containing fuels (coal, oil, gas).
- Carbon monoxide (CO) & particulates: Incomplete combustion in vehicles and industries.
- Methane (CH_4): Decomposition of vegetation and waste gases from digestion in animals.
- Oxides of nitrogen (NO, NO_2): High-temperature reactions in car engines.
- Sulfur dioxide (SO_2): Burning of sulfur-containing fossil fuels.
- Ground level ozone (O_3): Reaction of NO_x and volatile organic compounds in presence of sunlight.

2. Write adverse effects of some major air pollutants.

- CO_2: Global warming → climate change.
- CO: Toxic, binds with hemoglobin reducing oxygen transport.
- Particulates: Cause respiratory problems and cancer.
- CH_4: Greenhouse gas → global warming.
- NO_x: Cause acid rain, photochemical smog, respiratory problems.
- SO_2: Causes acid rain and haze.

Describe how greenhouse gases cause global warming?

Greenhouse gases like CO_2 and CH_4 absorb infrared radiation from the Earth's surface, trap heat in the atmosphere, and reduce heat loss to space. This leads to a gradual rise in Earth's temperature.
- CO_2: From burning fossil fuels.
- CH_4: From livestock farming and waste decomposition.

This trapped heat causes climate change, glacier melting, and extreme weather.

4. Describe any Six strategies to reduce environmental problems.

1. **Planting trees** – Absorbs carbon dioxide (CO_2) from the atmosphere, reducing greenhouse gas concentration and slowing climate change.
2. **Using low-sulfur fuels** – Decreases sulfur dioxide (SO_2) emissions, lowering the risk of acid rain.
3. **Installing catalytic converters in vehicles** – Converts harmful gases like carbon monoxide (CO) and nitrogen oxides (NO_x) into less harmful substances such as carbon dioxide (CO_2) and nitrogen (N_2).
4. **Increasing the use of renewable energy** – Promoting wind, solar, and hydroelectric power reduces dependency on fossil fuels and lowers greenhouse gas emissions.
5. **Reducing livestock farming** – Lowers methane (CH_4) emissions, a major greenhouse gas responsible for global warming.
6. **Flue gas desulfurization** – Using calcium oxide (CaO) in power plants to remove SO_2 from exhaust gases before they enter the atmosphere.

5. Explain how oxides of nitrogen form in car engines and describe their removal by catalytic converters.

Catalytic converters are devices installed in the exhaust system of vehicles to convert harmful gases into less harmful ones. Inside the converter, in the presence of a catalyst (platinum, palladium, or rhodium), nitrogen oxides react with carbon monoxide (CO) to produce carbon dioxide (CO_2) and nitrogen gas (N_2):

$$CO + 2NO \rightarrow 2CO_2 + N_2$$

This reaction reduces air pollution and prevents the release of acid rain–forming gases into the environment.