

Q 7. @ Explain the shape of water molecules with the help of Molecular Orbital Theory, also draw orbital diagram?

**Molecular Orbital Theory:** Molecular Orbital Theory explains how atoms combine to form molecules. When atomic orbitals from two atoms overlap, they create new molecular orbitals that belong to the entire molecule, not just individual atoms. These new orbitals are of two types.

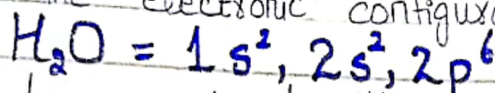
1: **Bonding Molecular Orbitals ( $\sigma$ ):**

These orbitals have lower energy and help hold the ~~en~~ atoms together.

**3: Anti-Bonding Molecular Orbitals ( $\sigma^*$ ):** These orbitals have higher energy and can weaken or break bonds if occupied by electrons.

## Molecular Orbital Structure of $H_2O$ :

The water molecules ( $H_2O$ ) has a total of 10 electrons and 10 protons. The electronic configuration of  $H_2O$  is:

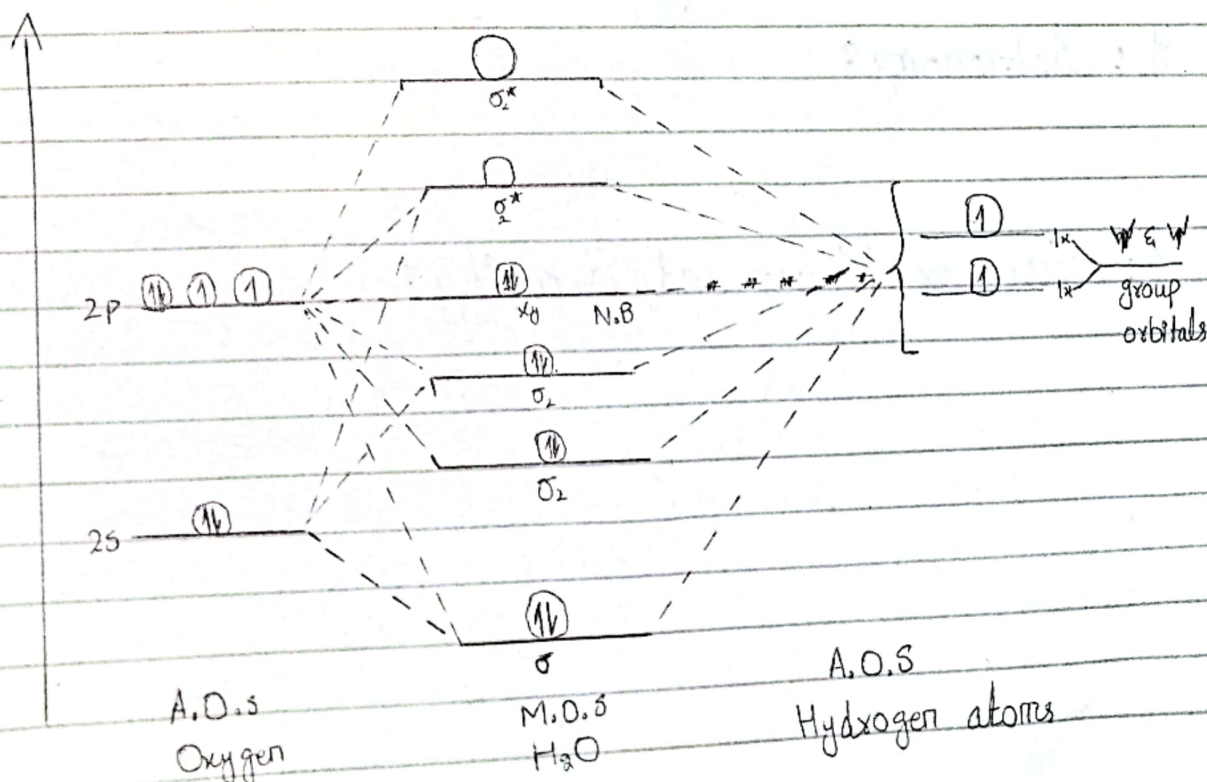


In the water molecule, the oxygen atom combines its 2s and 2p orbitals with the 1s orbitals of the two hydrogen atoms. This forms bonding and anti-bonding molecular orbitals.

**Bent Shape of Water:** The bent shape is due to two lone pairs on oxygen and two bond pairs with hydrogen, causing a bond angle of about  $104.5^\circ$ .

**Influence of Lone Pairs:** Lone pairs on oxygen push the bond pairs closer, creating the molecule's bent structure.

## Molecular Orbital diagram of $H_2O$ molecule:



**Part B:** What are the gamma rays? Explain their applications.

**Gamma Rays:** Gamma rays are very high-energy electromagnetic waves with the shortest wavelength and highest frequency in the electromagnetic spectrum. They are created by radioactive decay, nuclear reactions, and some processes in space. Gamma rays have no mass or charge, which allows them to pass through most materials easily.

### Applications of Gamma Rays:

1: **Medical Imaging and Treatments:** Gamma rays are used in PET scans to see inside the body and in radiation therapy to treat cancer by destroying cancer cells.

2: **St sterilization:** Gamma rays are used to kill harmful bacteria, viruses, and other germs, making them useful for sterilizing medical tools, food, and medicines.

3: **Industrial Inspection:** Gamma rays help inspect the quality of materials and structures without causing damage, such as finding cracks in metal parts.

4: **Astronomy:** Scientists study gamma rays in space to learn about powerful events like supernovae, black holes, and gamma-ray bursts.

5: **Nuclear Power and Security:** Gamma rays are used in nuclear power plants to monitor reactions and in security to detect radioactive materials and ensure safety.

In conclusion, these applications demonstrate the importance of gamma rays in various fields, from healthcare to industry and beyond.

Q. No. 8: Part @: Discuss the importance of preservatives and antioxidants in food.

## Preservatives in Food

**Def:** Food preservatives are chemicals or substances added to food to keep it from spoiling and to make it last longer by stopping the growth of bacteria, molds, and yeast.

**Example:** Common preservatives include salt, sugar and vinegar.

### Importance of Preservatives:

- ① Helps food stay fresh longer by stopping harmful germs from growing.
- ② Makes food last longer, so less food goes bad and needs to be thrown away.
- ③ Prevents harmful bacteria from growing, which can make food unsafe to eat.
- ④ Allows us to have seasonal foods all year round.
- ⑤ Lets food be transported over long distances without spoiling.

## Antioxidants in Food

**Def:** Antioxidants are substances that slow down the process that makes food go bad by stopping it from reacting with oxygen.

**Example:**

Vitamin C and Vitamin E are common antioxidants found in foods.

### Importance of Antioxidants

- ① Prevents fats and oils in food from becoming rancid.

- ② Helps food keep its vitamins and minerals over time.
- ③ Slows down the process that makes food age and spoil.
- ④ Maintains the taste and color of food by preventing it from getting damaged by oxygen.
- ⑤ Helps lower the risk of diseases by preventing harmful reactions in the body.

In conclusion, preservatives and antioxidants are essential for keeping food fresh, safe, and nutritious, ensuring it remains available and enjoyable for longer periods.

**Part B:** Comment, Green House Effect is a blessing, also discussed Enhanced Green House Effect and its relation with global warming.

### Is the Greenhouse Effect a Blessing?

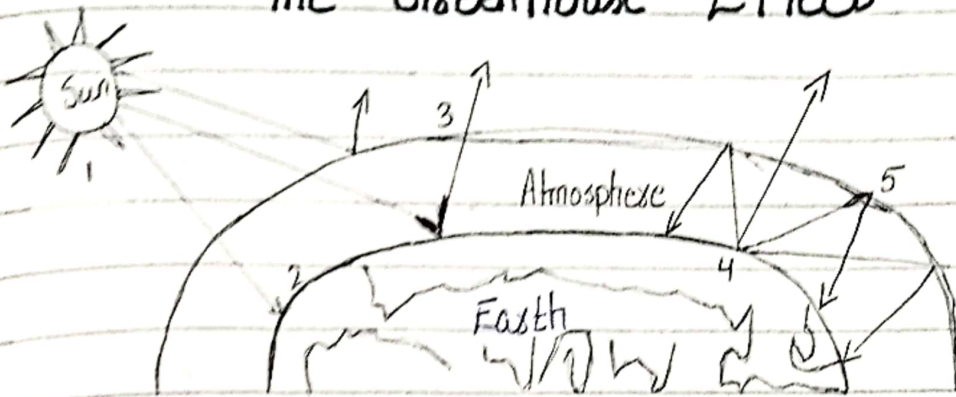
Yes, the natural greenhouse effect is a blessing, because it keeps Earth warm enough to support life by trapping heat from the Sun.

### How does the Greenhouse Effect Work?

The greenhouse effect works by allowing sunlight to enter Earth's atmosphere and reach the surface. When the surface absorbs this energy, it releases some of it as heat. Greenhouse gases in the atmosphere, such as carbon dioxide and methane, trap this heat, preventing it from escaping back into space. This process helps maintain Earth's temperature.

**Example:** Greenhouse effect is a greenhouse used in gardening. Sunlight enters through the glass walls, warming the air and soil inside. The glass traps the heat, keeping the greenhouse warmer than the outside environment, which helps plants grow in cooler weather.

# The Greenhouse Effect



**Enhanced Greenhouse Effect and its Relation to Global Warming:** The enhanced greenhouse effect occurs when human activities increased the concentration of greenhouse gases in the atmosphere, such as through burning fossil fuels and deforestation. The extra heat trapped by the increased greenhouse gases leads to global warming, causing Earth's average temperature to rise.

**Significant Factors are contributing to "enhanced greenhouse effects"**

- ① Deforestation to reduce and store CO<sub>2</sub>.
- ② Production of CO<sub>2</sub> from the burning of fossil fuels.
- ③ Release of CO<sub>2</sub> from cement production.
- ④ Release of nitrogen oxide from the use of high nitrogen fertilizers.
- ⑤ Intensive production of livestock, which produces methane.

**Q No. 1: Part A:** What are the factors responsible for environmental pollution?  
**Environmental Pollution:**

Environmental Pollution is when harmful substances or actions contaminate the natural environment, causing damage to the air, water, soil and living things. This happens when pollutants like chemicals, waste or noise are released into the environment, harming the ecosystem and posing risks to human health and animals.

## Factors Affecting Environmental Pollution

**1: Human Activities:** Actions like industrial production, vehicle use, and farming that contribute to pollution.

**2: Industrial Emissions:** Factories release harmful gases and chemicals into the air.

**3: Vehicular Emissions:** Cars, trucks, and buses emit smoke and exhaust fumes.

**4: Agricultural Practices:** Use of pesticides and fertilizers pollutes soil and water.

**5: Deforestation:** Cutting down trees reduces clean air and increases carbon dioxide.

**6: Waste Management:** The process of handling and disposing of waste, which can impact the environment if done improperly.

**a: Improper Waste Disposal:** Dumping garbage in open areas causes land pollution.

**b: Plastic Pollution:** Plastic waste clogs water bodies and harms marine life.

**c: Sewage and Water Waste:** Untreated sewage released into rivers pollutes water.

d: **Electronic Waste**: Improper disposal of electronic devices releases toxic materials.

3: **Natural Factors**: Natural events like volcanic eruptions, forest fires, and soil erosion that can cause environmental pollution.

a: **Volcanic Eruptions**: Release ash and gases into the atmosphere.

b: **Forest Fires**: Produce smoke and carbon, polluting the air.

c: **Soil Erosion**: Leads to dust and sediment in water bodies.

d: **Natural Disasters**: Floods and storms spread pollutants over large areas.

**Part B**: Briefly explain the main reasons of water-logging in Pakistan?

**Water-Logging**: Water-logging is happen when the soil is filled with too much water, causing the water level to rise near or above the surface. This leads to water staying on the surface, which can harm crops and lower soil quality.

**Reason of Water-Logging in Pakistan:**

Water-logging is one of the most severe impediments to the agriculture productivity of irrigated lands in Pakistan. It, along with salinity, is responsible for 25% of the affected irrigated land, resulting in the reduction of crop yields. Following are the reasons behind water-logging in Pakistan.



## 1: Poor Drainage Systems:

Inadequate drainage systems in agricultural fields lead to water accumulation, causing water-logging.

2: Over-Irrigation: Excessive use of water for irrigation, especially in areas with poor drainage, leads to water-logging.

3: Canal Seepage: Water seeps from unlined canals into the surrounding soil, raising the water table and causing water-logging.

4: River Flooding: Flooding of rivers during the monsoon season can saturate the soil, leading to water logging.

5: Flat Topography: In areas with flat terrain, water does not drain naturally, contributing to water logging.

**Part C** What do you mean by Ozone depletion, and how can prevent its depletion?

## Ozone layer:

The ozone layer is a protective layer in the Earth's atmosphere that absorbs most of the Sun's harmful ultraviolet (UV) radiation, preventing it from reaching the Earth's surface.

## Ozone layer Depletion:

Ozone layer depletion refers to the thinning of the ozone layer, which leads to increased levels of UV radiation reaching the Earth, causing potential harm to living organisms.

**Causes of Ozone Layer:** Ozone layer depletion is mainly caused by human activities, particularly the release of certain chemicals that break down ozone molecules. This results in a thinner ozone layer that cannot effectively block harmful UV rays.

### Ozone-Depleting Substances

- ① Chloro Fluoro carbons (CFCs)
- ② Halons
- ③ Methyl Chloroform
- ④ Hydro Fluoro carbons

### Sources

Refrigerators, air-conditioners, solvents, dry-cleaning agents etc.  
Fire-extinguishers  
Adhesives, aerosols.  
Fire extinguishers, air conditioners, solvent

### Solutions to Ozone Layer Depletion:

#### 1: Avoid Using Ozone-Depleting Substances (ODS):

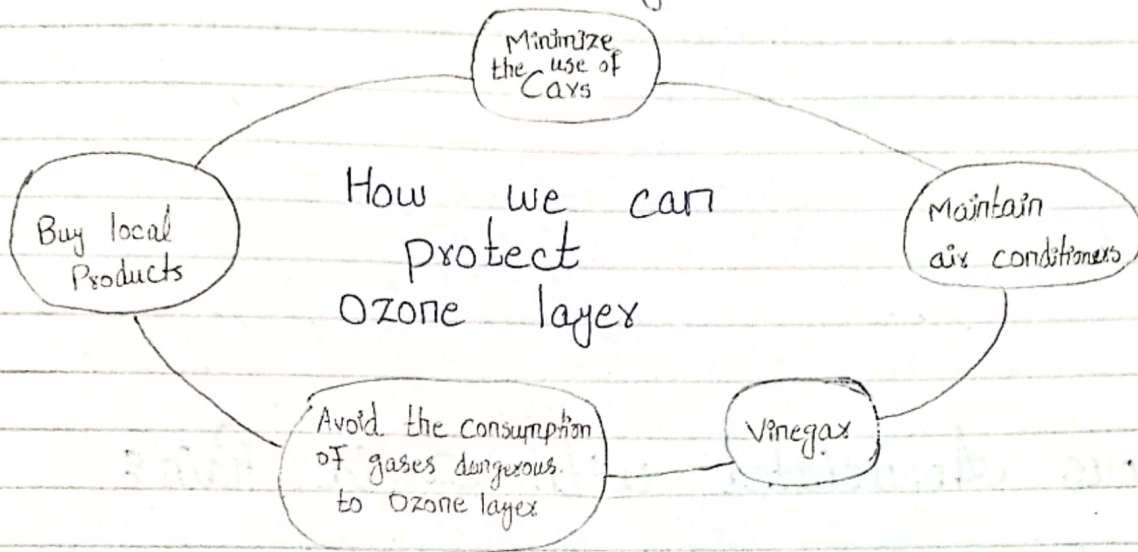
Reduce or eliminate the use of products that contain harmful chemicals like CFCs and halons.

#### 2: Minimize the Use of Vehicles: Reduce vehicle emissions by using public transport or opting for electric vehicles.

#### 3: Use of Eco-Friendly Cleaning Products: Choose cleaning products that do not contain harmful chemicals that can contribute to ozone depletion.

#### 4: Ban the Use of Nitrous Oxide: Implement strict regulations to ban or limit the use of nitrous oxide in industrial processes and agriculture.

In conclusion, taking these steps to protect the ozone layer will help ensure a safer environment for current and future generations.



**Part D:** What is an acid rain and how it is produced. Briefly describe the dangers associated with it?

**Acid Rain:** Acid rain is a type of rain that contains high levels of sulfuric and nitric acids. It includes any kind of rain, snow or fog that come down from the atmosphere, which can harm the environment.

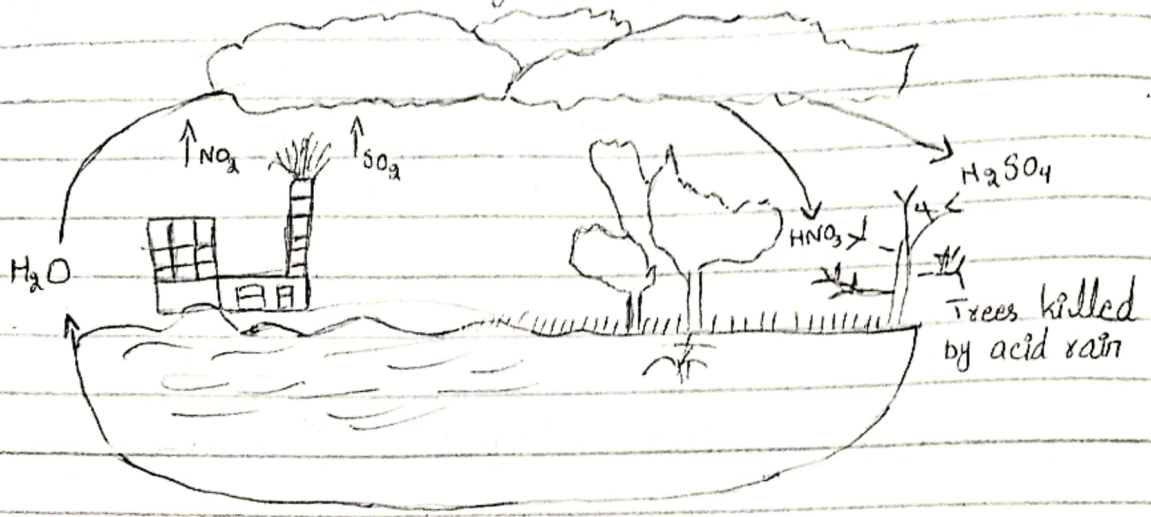
**How Acid Rain is Produced?**

It can be produced both as dry as well as wet deposition form.

**1. Wet Deposition:** Wet deposition happens when acidic chemicals mix with rain, snow or fog, and fall to the earth, affecting water sources, soil, and living organisms.

**2. Dry Deposition:** Dry deposition occurs when acidic particles and gases settle on surfaces like building, plants, and soil without moisture. Later, rain can wash these particles off.

causing more environmental damage.



## Dangerous Associated with Acid Rain:

### 1: Risk for Surface Water and Aquatic Animals:

Acid rain can make lakes, rivers, and streams more acidic, which can harm or kill fish and other aquatic life.

2: **Damage to Soil:** Acid rain removes important nutrients from the soil, making it less fertile and harming plant growth.

3: **Adverse Effects on Human Health:** The pollutants that cause acid rain can lead to health problems like asthma and bronchitis when inhaled.

4: **Destruction of Vegetation and Forests:** Acid rain weakens trees and plants by damaging their leaves and removing nutrients from the soil, making them more prone to disease.

5: **Harm to Historical Buildings:** Acid rain can erode building materials like limestone and marble, damaging historical monuments and structures. Like Badshahi Mosque (Pakistan), and Taj Mahal (India).

In conclusion, taking step to prevent acid rain is crucial to protect the environment, human health, and important cultural sites.