Climate Change Topic

Atmospheric composition:

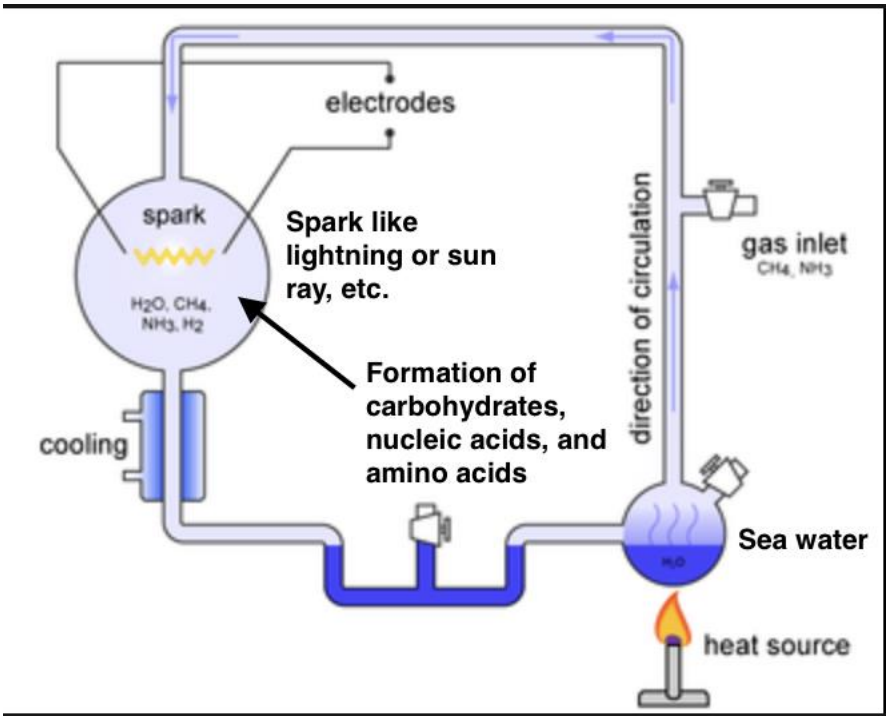
The Earth's atmosphere is a layer of gases that surrounds the planet and is held in place by the force of gravity. It consists mainly of nitrogen (about 78%) and oxygen (about 21%), with trace amounts of other gases such as argon, carbon dioxide, and water vapor. The atmosphere plays a crucial role in regulating the planet's temperature, protecting life from harmful solar radiation, and providing the air we breathe.

Percentage composition:

78% nitrogen, 21% oxygen, 0.96% argon, 0.04% carbon dioxide

The value of pollutant gases or greenhouse gases increase continuously meaning that 0.04% carbon dioxide will increase next year as we keep using cars and factories keep burning fossil fuels.

The Miller Urey experiment:



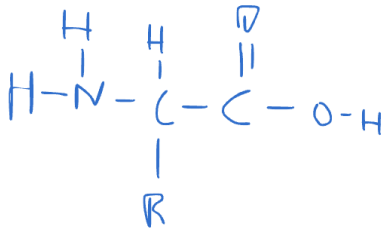
The Miller-Urey experiment was conducted in the past to try and prove the theory of evolution on Earth. The basic building blocks of life and organisms are carbohydrates, amino acids, and nucleic acids. Nucleic acids are what create DNA and RNA, amino acids are proteins. All these components would form together to create organisms in the past,

hence proving the theory of evolution. In this experiment, you take a sample of sea water, and heat it up so it passes through the system to reach the spark. In the past, there was an abundance of gases like ammonia, methane, hydrogen, and water vapor in the atmosphere. So, when lightning occurred, or sun rays impacted these gases, they reacted with water to form the basic building blocks of life. Hence the spark is induced here to act as the lightning from the past. Once the water reacts with methane or ammonia in the presence of the spark, they create the basic building blocks in that compartment which is the proof of evolution.

Formation of the building blocks of life:

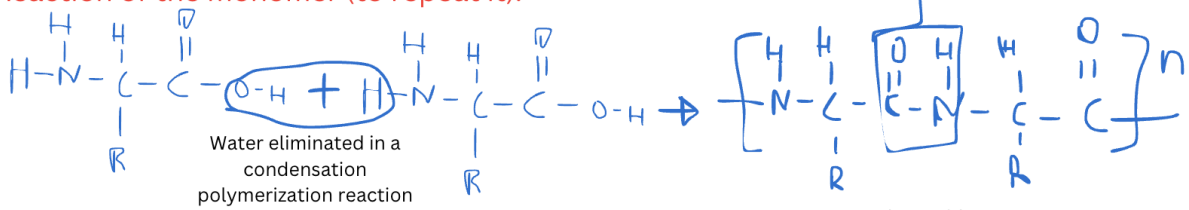
To create polypeptides (A protein), you need to repeat the monomer amino acids.

Amino acids structure:



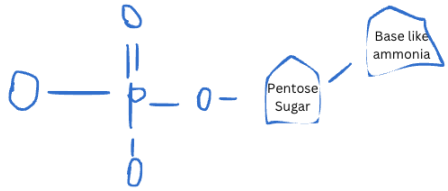
From the experiment, ammonia reacts with methane and water to produce this as proof of the theory of evolution.

Reaction of the monomer (to repeat it):



To create polynucleotide (the polymer which makes DNA and RNA), you need the monomer nucleotides to repeat:

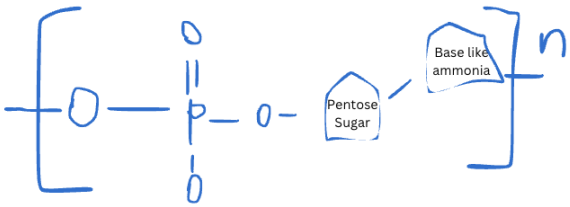
Nucleotide structure:



Phosphate bonded to pentose sugar bonded to a base like ammonia. The base is adenine, thymine, cytosine, and guanine

In the compartment, some of the gases that existed in Earths atmosphere like phosphorus and ammonia bond to form this polymer in the compartment of the reaction which is proof of the theory of evolution and life in the past.

The repeat to form polynucleotide which is what makes DNA and RNA:



Lastly, certain gases bond to form carbohydrates. These products are proof of life in the

past because they are the building blocks of all organisms, hence this experiment tells you a lot about how organisms were created on Earth in the past.

Greenhouse effect:

Type of greenhouse gas	What is its source	Relative effects
Carbon dioxide	Burning fossil fuels, driving cars, etc.	When CO2 levels in the atmosphere increase, it enhances the atmosphere's ability to trap heat from the sun, leading to a rise in global temperatures. Additionally, increased CO2 levels can also affect ocean chemistry, leading to ocean acidification.
Methane	Livestock farming, rice cultivation, waste management	Methane is considered a potent greenhouse gas, with a much higher global warming potential than carbon dioxide over a 20-year timeframe. Pound for pound, methane has a significantly greater warming effect compared to carbon dioxide. However, carbon dioxide still remains the primary driver of long-term climate change due to its abundance and long atmospheric lifetime.
Nitrogen oxides	Driving cars, industrial practices, power plants, and use of synthetic fertilizers	They contribute to the formation of ground-level ozone and smog, which can have adverse effects on human health and vegetation. Nitrogen oxides also play a role in the formation of acid rain when it reacts with water vapor in the atmosphere. In addition, nitrogen oxides are involved in the complex chemistry of the

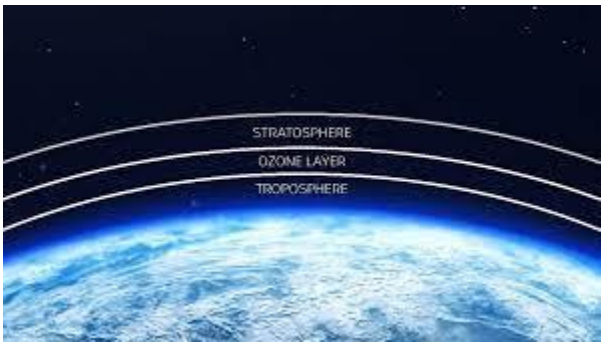
		atmosphere, contributing to the formation of particulate matter and influencing the concentrations of other greenhouse gases. Furthermore, Nitrogen oxides can contribute to the depletion of the ozone layer in the upper atmosphere.
Water vapor	Evaporation from lakes, oceans, and soil.	As the most abundant greenhouse gas in the atmosphere, water vapor significantly contributes to the greenhouse effect and the regulation of the Earth's temperature. It absorbs and emits infrared radiation, trapping heat in the atmosphere and helping to maintain the planet's surface temperature within a range suitable for supporting life. Water vapor also plays a crucial role in the formation of clouds and precipitation. It is the primary component of clouds, which have a significant influence on the Earth's energy balance by reflecting sunlight back into space.

Formation of ozone layer:

The ozone layer is formed in the Earth's stratosphere through the interaction of ultraviolet (UV) radiation from the sun and molecular oxygen (O2). When high-energy UV radiation strikes an oxygen molecule (O2), it can cause the molecule to split into two individual oxygen atoms. These highly reactive oxygen atoms can then combine with other oxygen molecules to form ozone (O3).

The formation of the ozone layer is a dynamic process involving the continuous creation and destruction of ozone molecules. Ozone is also broken down by UV radiation, leading to a delicate balance between ozone formation and destruction.

The ozone layer plays a crucial role in absorbing the majority of the sun's harmful UV radiation, which helps protect life on Earth from the damaging effects of excessive UV exposure. This process is vital for maintaining the balance of life on our planet.



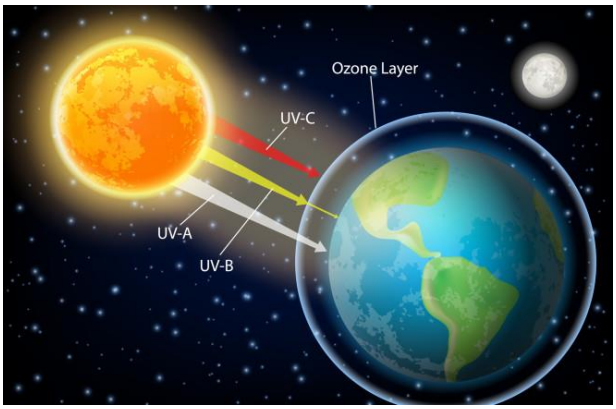
Ozone depletion:

Ozone depletion refers to the reduction in the concentration of ozone (O3) in the stratosphere. The primary cause of ozone depletion is the release of human-made chemicals known as ozone-depleting substances (ODS), such as chlorofluorocarbons (CFCs), halons, and other related compounds.

Chemically, the process of ozone depletion involves the interaction of ODS with ozone molecules in the stratosphere. When ODS are released into the atmosphere, they eventually reach the stratosphere, where they are broken down by UV radiation. This process releases chlorine and bromine atoms from the ODS molecules.

The released chlorine and bromine atoms then catalyze the destruction of ozone in a series of chemical reactions. For example, chlorine atoms can react with ozone molecules, leading to the breakdown of ozone into oxygen molecules and individual oxygen atoms. These chlorine and bromine-catalyzed reactions are responsible for the reduction in the concentration of ozone in the stratosphere.

As a result of ozone depletion, the protective ozone layer is weakened, allowing more harmful UV radiation to reach the Earth's surface. This can have detrimental effects on human health, ecosystems, and the environment.



The greenhouse effect:

The greenhouse effect is a natural process that warms the Earth's surface. It occurs when certain gases in the Earth's atmosphere, known as greenhouse gases, trap heat from the sun, preventing it from escaping back into space. These greenhouse gases include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and water vapor.

Here's how the greenhouse effect works: Solar radiation from the sun enters the Earth's atmosphere. Some of this incoming solar radiation is absorbed by the Earth's surface, warming it. The Earth's surface then emits infrared radiation (heat) back into the atmosphere. Greenhouse gases in the atmosphere absorb and re-emit some of this infrared radiation, trapping heat and causing the warming of the lower atmosphere.

The natural greenhouse effect is essential for maintaining the Earth's temperature at a level suitable for supporting life. However, human activities, such as the burning of fossil fuels, deforestation, and industrial processes, have significantly increased the concentration of greenhouse gases in the atmosphere. This enhanced greenhouse effect has led to global warming and climate change, with far-reaching impacts on weather patterns, sea levels, ecosystems, and human societies. Efforts to mitigate the enhanced greenhouse effect and its associated impacts are crucial for addressing climate change.

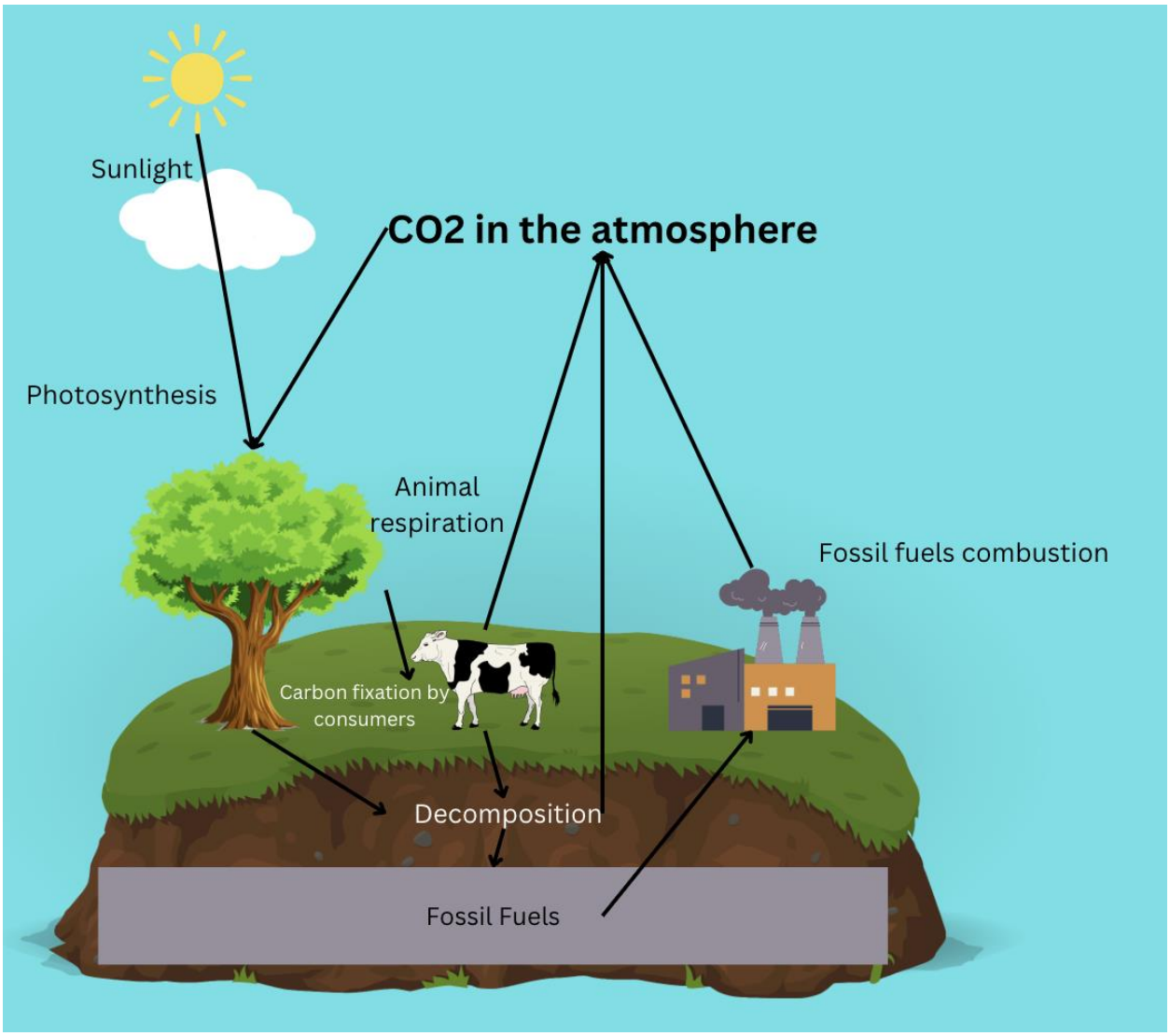
Carbon footprint definition:

A carbon footprint is a measure of the total amount of greenhouse gases, specifically carbon dioxide, produced directly and indirectly by human activities such as driving a car, using electricity, and manufacturing goods. It represents the impact of an individual, organization, event, product, or service on the environment in terms of the amount of greenhouse gases emitted, contributing to climate change.

Nutrient Cycle:

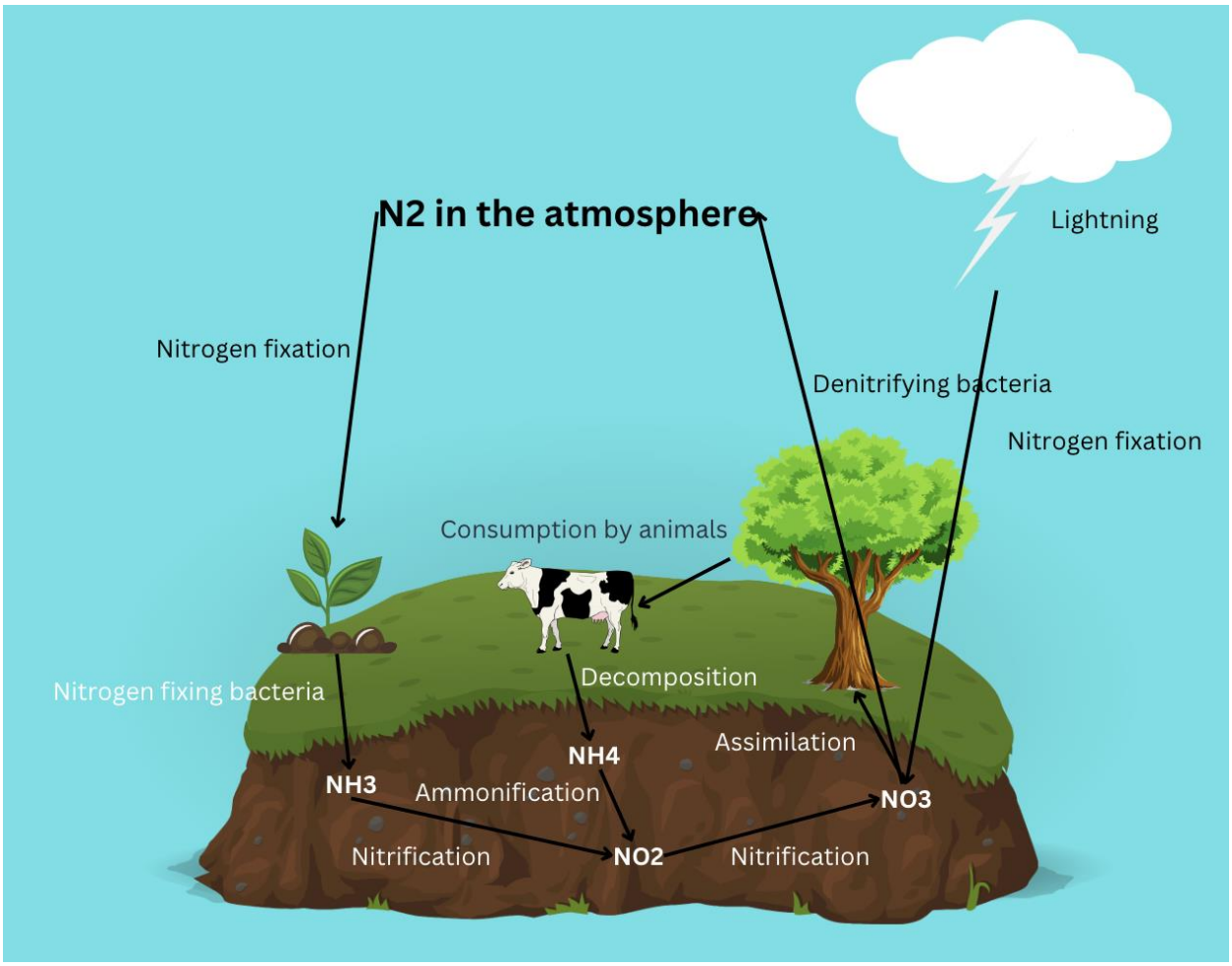
Carbon cycle:

This cycle explains how carbon originally existed in Earth's atmosphere, and how it gets decomposed, used by living beings then redistributed back to Earth's atmosphere.



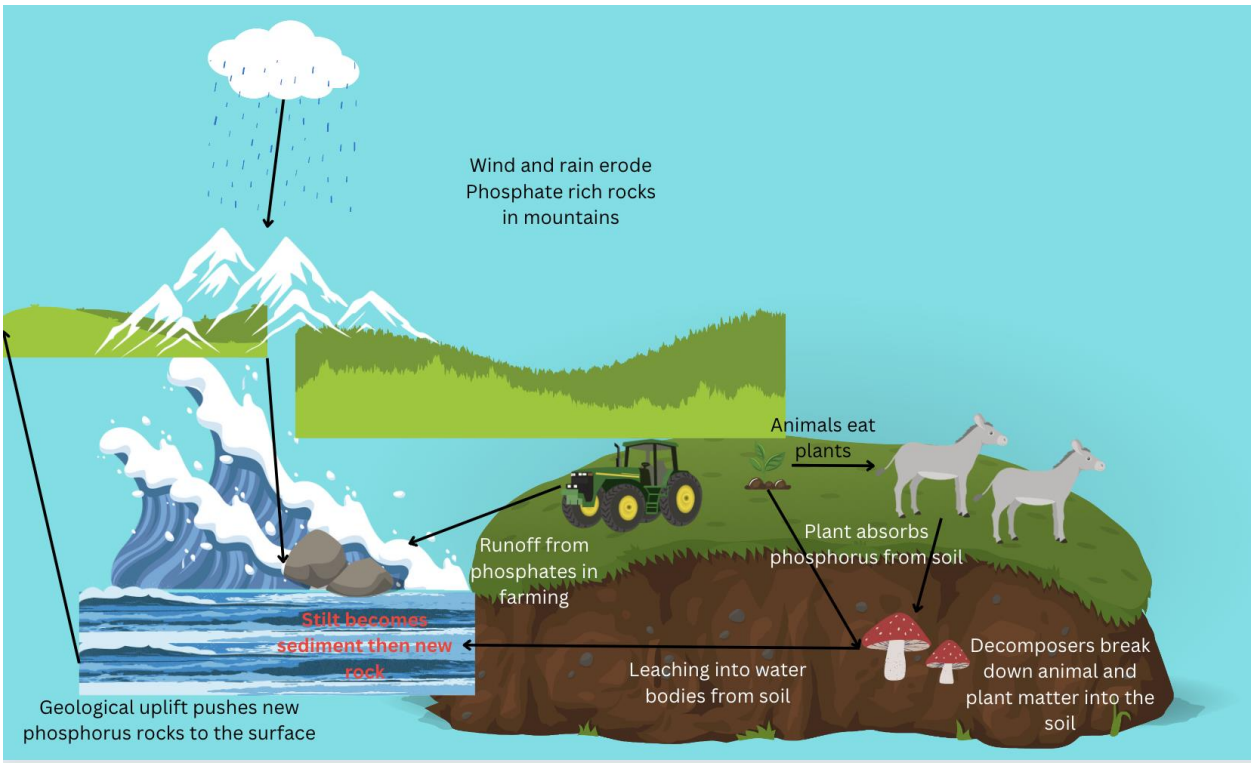
Nitrogen cycle:

This cycle explains how Nitrogen originally existed in Earth's atmosphere, and how it gets decomposed, used by living beings then redistributed back to Earth's atmosphere.



Phosphorus cycle:

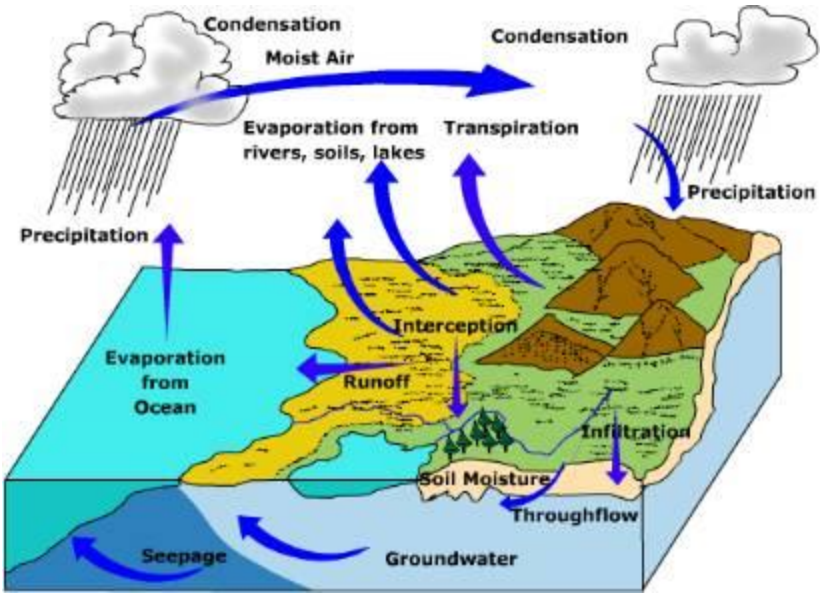
This cycle explains how Phosphorus originally existed in Earth's atmosphere, and how it gets decomposed, used by living beings then redistributed back to Earth's atmosphere.



Sources of water and air pollution:

Basic sources of water pollution include industrial discharge, agricultural runoff, untreated sewage, and improper disposal of waste. Industrial discharge can introduce harmful chemicals and heavy metals into water bodies, while agricultural runoff can carry pesticides, fertilizers, and animal waste into rivers and lakes. Untreated sewage, whether from urban areas or poorly managed sewage systems, can contaminate water with pathogens and organic matter. Improper disposal of waste, including litter, plastics, and hazardous materials, can also contribute to water pollution. Additionally, oil spills, mining activities, and urban runoff from roads and construction sites are other common sources of water pollution.

How the atmosphere interacts with the water cycle:



Different ways pollution is caused:

Pollution can be caused by various human activities and natural processes. Human activities such as industrial processes, transportation, agriculture, and waste disposal contribute to pollution through the release of harmful substances into the environment. Industrial activities release pollutants such as chemicals, heavy metals, and particulate matter into the air, water, and soil. Transportation, especially from vehicles powered by fossil fuels, emits pollutants like nitrogen oxides, carbon monoxide, and particulate matter. Agricultural practices involving the use of fertilizers, pesticides, and animal waste can lead to water and soil pollution. Improper waste disposal, including littering and the release of hazardous materials, also contributes to pollution. Additionally, natural processes such as volcanic eruptions, wildfires, and decomposition can release pollutants into the environment, though human activities are the primary contributors to pollution on a global scale.