UNIT I

GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION

1.1.1 Introduction to Geo Environmental Engineering & Environmental cycles

Introduction to Geo-Environmental Engineering

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Carbon Cycle

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1.1.1 Introduction to Geo-Environmental Engineering

Definition of Geo-Environmental Engineering

Geo-Environmental Engineering is an evolving field of study, involving diverse fields as geotechnical, environmental and chemical engineering, geology, hydrogeology, chemistry, microbiology and soil sciences, dealing with pollutants in the environment, protecting ecological and human health.

Need for Geo-Environmental Engineering

Geo-environmental Engineering addresses issues related to complex problems, such as containment systems (such as landfills), contaminant transport, remediation of contaminated sites, and material reuse.

Scope of Geo-Environmental Engineering

A geo-environmental engineer should work in an open domain of knowledge and should be willing to use any concepts of engineering and science to effectively solve the problem at hand. The most challenging aspect is to identify the unconventional nature of the problem, which may have its bearing on multiple factors. For example, an underground pipe leakage may not be due to the faulty construction of the pipe but caused due to the highly corrosive soil surrounding it. The reason for high corrosiveness may be attributed to single or multiple manmade factors, which need to be clearly identified for the holistic solution of the problem. The conventional approach of assessing the material strength of the pipe alone will not solve the problem at hand.

Applications of Geo-Environmental Engineering

Geo-environmental engineering concerns the application of principles of geomechanics in conjunction with environmental engineering and encompasses (a) studies on safe handling, storage, and disposal of the waste**.**

Advantage of Geo-Environmental Engineering

Geo-Environmental Engineering evaluates site suitability, designs foundations, and ensures slope stability. Advantages of geotechnical engineering include enhanced safety, cost optimization, increased efficiency, and sustainable solutions.

1.1.2 Environmental cycle

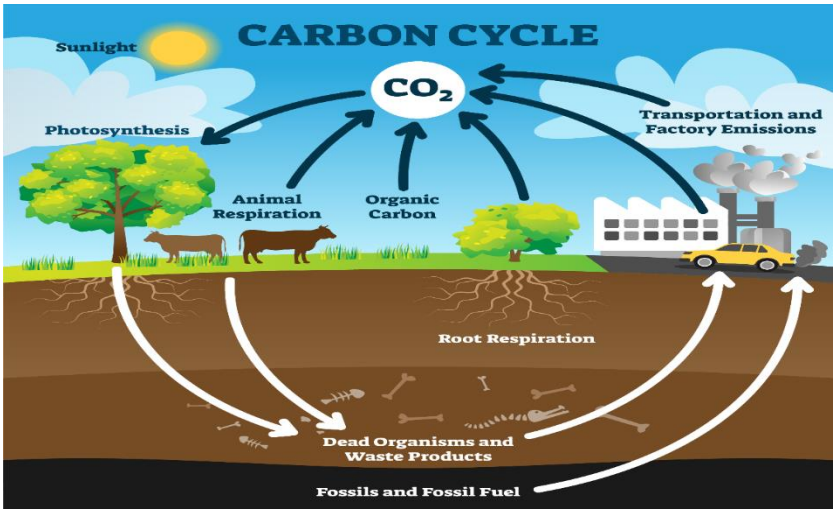
Definition

A natural process in which elements are continuously cycled in various forms between different compartments of the environment (e.g., air, water, soil, organisms). Environmental cycles are otherwise known as Biogeochemical cycles or nutrient cycles.

The various environmental cycles are,

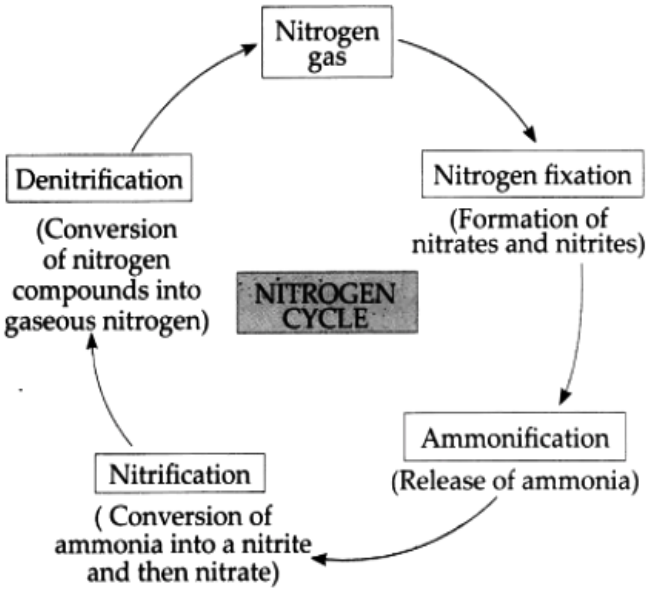
1. **Carbon Cycle**
2. **Nitrogen cycle**
3. **Phosphorus cycle**
4. **Water cycle**

The **carbon cycle** includes the uptake of carbon dioxide by plants through, its ingestion by animals and its release to the atmosphere through respiration and decay of organic materials. Human activities like the burning of fossil fuels contribute to the release of carbon dioxide in the atmosphere.

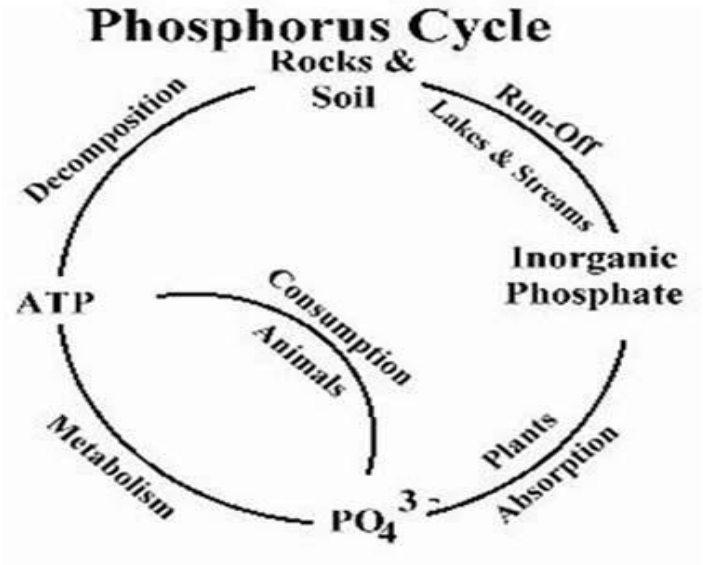


The **nitrogen cycle** involves the uptake of nitrogen form the atmosphere by a process called fixation which is carried out by microbes or industrial processes. Decomposition of biological waste by microbes can return nitrogen to the atmosphere. Nitrogen is mainly

used by humans as a fertilizer in farmlands, but its excessive usage can lead to serious problems (such as eutrophication).



The **phosphorus cycle** involves the uptake of phosphorus by organisms. Phosphorus in the environment is mainly found in rocks, and natural weathering processes can make it available to biological systems. After decomposition of biological waste, it can accumulate in large amounts in soils and sediments. Phosphorus is used by humans as a fertilizer in farmlands and in detergents. Overuse of phosphorus can lead to eutrophication.



The **water cycle** is the process by which water travels in a sequence from the air (condensation) to the earth (precipitation) and returns to the atmosphere (evaporation). It is also referred to as the hydrologic cycle.