Introduction to Environmental Chemistry

- What do we understand as Environmental Chemistry?
- Why is it important that we understand and know Environmental Chemistry?
- What areas of knowledge are related to Environmental Chemistry, and how can we use this concept?

What's environment and environmental chemistry?

- **The environment** was defined as the surroundings or conditions in which a person, animal, or plant lives or operates.

Consisting of five spheres:

The Hydrosphere	→	Water
The Atmosphere	→	Air
The Geosphere	→	The Earth
The Biosphere	→	Life
The Anthrosphere	→	Those parts of the environment consisting of human constructs and activities.

What's environment and environmental chemistry?

- **Environmental chemistry**: The study of the sources, reactions, transport, effects, and fates of chemical species involving all environmental spheres.

- Environmental chemistry is complicated by the continuous and variable interchange of chemical species among various environmental spheres.

Importance of Environmental Chemistry

- The knowledge of Environmental Chemistry is essential for understanding what happens in nature and for predicting the fate and the chemical reactions that natural compounds and artificial pollutants may undergo; for understanding their interactions, and for predicting what may happen to certain compounds if discharged into the environment, and if organisms (human or not) come into contact with them.

- * Dissolution
  * Hydrolysis
  * Precipitation
  * Photolysis
  * Biodegradation
  * Adsorption/Desorption
  * Oxidation-reduction
  * Ion Exchange
  * Complexation
  * Polymerization

reactions taking place in the environment, may affect the solubility of pollutants and therefore their mobility, speciation, and toxicity.

CARBON CYCLE

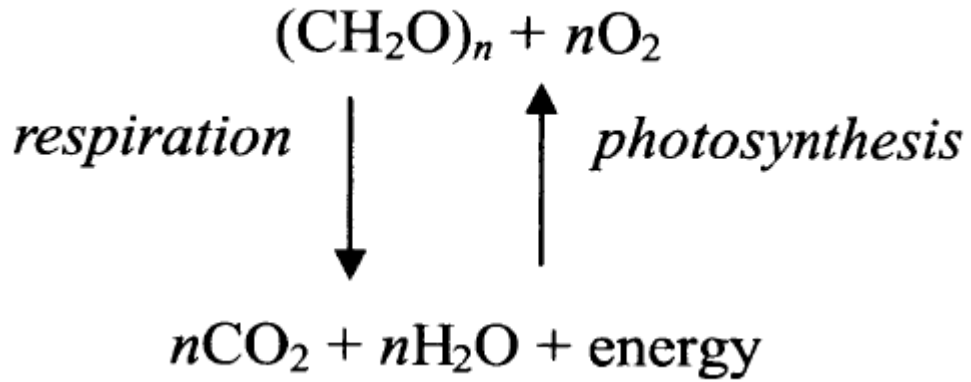
- The **carbon cycle** is the process which carbon is cycled through the air, ground, plants, animals, and fossil fuels.
- This process can be summarize as below:

The carbon dioxide travels from the atmosphere into living organisms and the Earth, then back into the atmosphere. Plants take carbon dioxide from the air along with water and photosynthesis from the sun and use it to make food. Animals then eat the food and carbon is stored in their bodies and released. Most of the carbon they consume is exhaled as carbon dioxide. The CO_2 then is returned to the atmosphere where the plants use it again.

- From a biological perspective, the key events of this cycle are the complementary reactions of *respiration and photosynthesis*.

Respiration takes carbohydrates and oxygen and combines them to produce carbon dioxide, water, and energy.

Photosynthesis takes carbon dioxide and water and produces carbohydrates and oxygen. The outputs of respiration are the inputs of photosynthesis, and the outputs of photosynthesis are the inputs of respiration.



- If glucose is used as the substrate for respiration, the reaction is the following:

$$C_6H_{12}O_6 + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O$$

- The reactions are also complementary in the way they deal with energy. Photosynthesis takes energy from the Sun and stores it in the carbon-carbon bonds of carbohydrates; respiration releases that energy. Both, plants and animals accomplish respiration, but only plants (and other producers) can accomplish photosynthesis.

- Then, plants take up carbon dioxide and convert it into carbohydrates.

- This carbon in the plants has three possible fates: it can be liberated to the atmosphere by the plant through respiration; it can be eaten by an animal; or it can be present in the plant when the plant dies.