Photosynthesis: The Life-Sustaining Process

Definition:
Photosynthesis (Photo = light, Synthesis = to join) is the process by which **green plants, algae, and certain bacteria** use **sunlight, carbon dioxide (CO_2), and water (H_2O)** to produce **glucose ($C_6H_{12}O_6$)**, a form of chemical energy. This process also releases **oxygen (O_2)** as a byproduct, which is essential for the survival of most living organisms.

Overall Chemical Equation:

- **Carbon dioxide** is absorbed from the atmosphere.
- **Water** is absorbed by roots from the soil.
- **Sunlight** provides the energy.
- **Chlorophyll**, the green pigment in plants, captures light energy.
- **Oxygen** released comes from the **splitting of water molecules** (photolysis), **not** from C

Site of Photosynthesis:

- Takes place mainly in the **leaves**.
- **Mesophyll cells** in the leaves contain **chloroplasts**, the actual site of photosynthesis.
- Chloroplasts act as **solar energy converters**.

Steps Involved in Photosynthesis:

1. **Light Reaction (Occurs in presence of light):**
    - Happens in the **thylakoid membranes** of chloroplasts.
    - Water is split, releasing oxygen.
    - Light energy is converted to chemical energy (ATP and NADPH).
2. **Dark Reaction (Calvin Cycle):**
    - Occurs in the **stroma** of chloroplasts.
    - CO_2 is fixed to form glucose using ATP and NADPH from the light reaction.

Significance of Photosynthesis:

1. **Primary source of energy** for all living beings.
2. Produces **oxygen** necessary for **aerobic respiration**.
3. Basis of the **food chain** – all animals depend on plants.
4. Converts **inorganic molecules into organic compounds** (carbohydrates, proteins, fats, nucleic acids).
5. Maintains the balance of **CO_2 and O_2** in the atmosphere.
6. Provides **raw materials for fossil fuels** like coal, petroleum, and natural gas.
7. Green plants (autotrophs) are **self-sustaining**, while animals (heterotrophs) rely on them.

Did You Know?

- Without photosynthesis, life on Earth would **cease to exist**.

- Almost all oxygen in the atmosphere is the result of **billions of years of photosynthesis**.

Conclusion:

Photosynthesis is not just a plant process — it is the **foundation of life** on Earth. It enables the production of food, supports oxygen supply, and drives the energy flow in ecosystems.
Understanding this process highlights the **vital role of plants** in maintaining environmental and biological balance.