

# Photosynthesis

These notes are your ultimate revision weapon to revise Photosynthesis. We've distilled years of previous exam questions (PYQs) into one powerful, concise resource. Everything you need to know, nothing you don't.

- **PYQs, Decoded:** All key concepts from past exams, organized and simplified.
- **Revise in Record Time:** Short, precise, and designed for last-minute review.
- **Focus on What Matters:** Master high-probability topics and boost your confidence.

## Photosynthesis: A Comprehensive Overview

### Definition and Core Concept

- **Definition:** The process by which green plants and other organisms synthesize their own food (glucose).
- **Energy Conversion:** It converts light energy (solar energy) into chemical energy stored in the bonds of sugar molecules.

### Chemical Reaction

- **Overall Balanced Equation:**  
$$6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow{\text{Light Energy / Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2$$
- **Reactants (Inputs):** Carbon Dioxide ( $\text{CO}_2$ ) and Water ( $\text{H}_2\text{O}$ ). Sunlight is the energy source.
  - *Note:* Oxygen ( $\text{O}_2$ ) is a product, not a reactant.
- **Products (Outputs):**
  - **Main Product:** Glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ).
  - **By-product:** Oxygen ( $\text{O}_2$ ), which is released into the atmosphere.

- **Source of Liberated Oxygen:** The oxygen gas released comes exclusively from the **photolysis** (splitting) of **water molecules**, not from carbon dioxide.

## Site and Organisms

- **Cellular Site:** Occurs within organelles called **chloroplasts**.
- **Primary Organ:** The **leaf** is the main organ for photosynthesis.
  - **Lamina:** The broad, flat part provides a large surface area to absorb sunlight and CO<sub>2</sub>.
  - **Stomata:** Tiny pores that allow for gas exchange (CO<sub>2</sub> enters, O<sub>2</sub> exits).
- **Key Organisms:**
  - **Global Oxygen Production:** The majority of Earth's oxygen is produced by **algae** in the oceans.
  - **Efficient Converter: Chlorella** (a single-celled green alga) has maximum efficiency in converting solar energy to chemical energy.



## Light Requirements and Effectiveness

- **Light Requirement:** Occurs only in the presence of **visible light** (wavelengths between 3800 Å and 7600 Å).
- **Light Sources:**
  - Primarily sunlight, but it can also occur under **artificial light**.
  - Some marine algae can utilize **moonlight**.
- **Light Absorption by Chlorophyll:**
  - **Absorbed Light:** Strongly absorbs **blue, red, and violet** light.
  - **Reflected Light:** **Green** light is not absorbed effectively and is reflected, making plants appear green.
- **Most Effective Light for Photosynthesis:**
  - **Red light** is the most effective.
  - **Blue light** is the next most effective.

- *Evidence:* Demonstrated by **Engelmann's experiment (1888)**, which showed maximum oxygen production (indicated by aerobic bacteria accumulation) under red light.
- **Exception:** Some bacteria (e.g., green sulphur bacteria) can perform photosynthesis using invisible **infrared light**.

## Process Details and Energy

- **Molecular Requirements for Glucose:** To synthesize one molecule of glucose ( $C_6H_{12}O_6$ ), the process requires:
  - 6 molecules of  $CO_2$
  - 18 molecules of ATP
  - 12 molecules of NADPH
- **Site of Energy Conversion:** The conversion of light energy into chemical energy (as ATP and NADPH) occurs in the chloroplasts during the **light-dependent reactions**.
- **Role of Plant Parts:**
  - **Leaves:** Primary site due to chlorophyll content and adaptations for light/ $CO_2$  absorption.
  - **Roots:** Do **not** perform photosynthesis (lack chlorophyll). Their role is absorption and anchoring.

## Environmental Impact and Daily Cycle

- **Role in the Carbon Cycle:** Photosynthesis **removes  $CO_2$**  from the atmosphere.
  - *Contrasts with:* Respiration, decay, and volcanic action, which **release  $CO_2$** .
- **Gas Exchange at Night:**
  - Photosynthesis stops at night due to the absence of light.
  - Plants only respire, consuming  $O_2$  and releasing  $CO_2$ .
  - This is why it is considered **harmful to sleep under a tree at night**, as oxygen levels decrease and  $CO_2$  levels increase locally.

## Know More About Photosynthesis:

- [Photosynthesis – Old Year Questions](#)
- [Photosynthesis One Liner Questions & Answers](#)

