Module 7: Photosynthesis

Keys to Success & Study Guide

Learning Objectives

By the end of this module, you should be able to:

1. **Trace** the flow of energy from sunlight to chemical bonds in glucose.
2. **Locate** the reactions of photosynthesis within the chloroplast structure.
3. **Explain** the inputs and outputs of the Light Reactions and the Calvin Cycle.
4. **Differentiate** between C_3, C_4, and CAM photosynthetic strategies.

Key Terminology Checklist

Define these terms in your own words to ensure mastery.

- [ ] **Photon**: A discrete packet of light energy.
- [ ] **Stomata**: Pores in leaves for gas exchange (CO_2 in, O_2 out).
- [ ] **Carbon Fixation**: The incorporation of atmospheric CO_2 into organic molecules.
- [ ] **$NADP^+$ /NADPH**: An electron carrier that transfers high-energy electrons in photosynthesis.
- [ ] **G3P (Glyceraldehyde-3-Phosphate)**: The direct product of the Calvin Cycle; precursor to glucose.

Concept Check

1. Photolysis

- **Question**: What happens in Photosystem II?
- **Key Answer**: Water is split (photolysis), releasing electrons to the photosystem, H^+ ions to the thylakoid lumen, and O_2 as a byproduct. This is the source of atmospheric oxygen.

2. Carbon Fixation

- **Question**: What does it mean to "fix" carbon?
- **Key Answer**: Carbon fixation converts gaseous CO_2 into stable organic molecules. RuBisCO catalyzes the first step of the Calvin Cycle, attaching CO_2 to RuBP.

3. C_3, C_4, and CAM Plants

- **Question**: Why did C_4 and CAM pathways evolve?
- **Key Answer**: In hot, dry conditions, C_3 plants lose efficiency due to photorespiration (RuBisCO binds O_2 instead of CO_2).
    - **C_4 plants**: Spatially separate initial CO_2 capture (mesophyll) from Calvin Cycle (bundle sheath).
    - **CAM plants**: Temporally separate CO_2 capture (stomata open at night) from fixation (day).