3.2.2 LIGHT-DEPENDENT AND LIGHT-INDEPENDENT REACTIONS

Introduction

Photosynthesis takes place through two coordinated stages known as the light-dependent reaction and the light-independent reaction.

Light-Dependent Reaction

This stage occurs in the thylakoid membranes. Chlorophyll absorbs sunlight energy, causing water molecules to split and release oxygen.

Photolysis

Photolysis refers to the splitting of water using light energy. The process forms electrons, hydrogen ions, and oxygen gas.

ATP and NADPH Formation

Captured solar energy is converted into ATP and NADPH. These compounds temporarily store energy required for glucose formation.

Light-Independent Reaction

The Calvin cycle occurs in the stroma of chloroplasts. Carbon dioxide is converted into carbohydrates using ATP and NADPH.

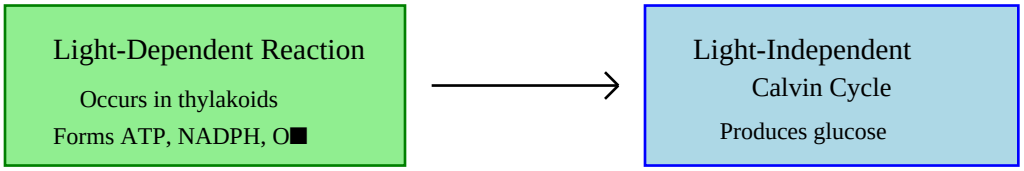
Carbon Fixation

Carbon dioxide combines with organic compounds to form glucose and other sugars needed for plant growth.

Importance

These reactions provide food energy for plants and support oxygen availability in the atmosphere.

Figure: Main Stages of Photosynthesis



Comparison Table

Feature	Light-Dependent	Calvin Cycle
Location	Thylakoid membrane	Stroma
Sunlight	Directly required	Indirectly required
Products	ATP, NADPH, Oxygen	Glucose
Main Activity	Water splitting	Carbon fixation

Summary

Photosynthesis depends on two interconnected reactions. The light-dependent stage captures sunlight and stores energy in ATP and NADPH, while the Calvin cycle uses this energy to synthesize glucose.

Questions and Answers

What is photolysis?

It is the splitting of water using light energy.

Where does the Calvin cycle occur?

It occurs in the stroma.

Which gas is released during photosynthesis?

Oxygen gas is released.

What compounds store temporary energy?

ATP and NADPH store temporary energy.

Why are both stages important?

They work together to produce glucose.

Study Notes

- Light-dependent reactions occur in thylakoids.
- Chlorophyll absorbs solar radiation.
- Oxygen forms during water splitting.
- ATP transfers chemical energy.
- NADPH carries hydrogen and electrons.
- The Calvin cycle synthesizes carbohydrates.
- Carbon fixation occurs in the stroma.
- Photosynthesis supports life on Earth.