LEAF STOMATE

GUARD CELLS

STOMATE

ATMOSPHERE

CO2

DIFFUSION

STOMA CLOSED
LEAF
STOMATE

GUARD CELLS

STOMA

STOMA CLOSED
PHOTOSYNTHESIS TRADE-OFF BETWEEN SUGAR SYNTHESIS AND WATER RETENTION
PHOTOSYNTHESIS

LEAF

PRINCIPLE

PHOTOSYNTHETIC ORGAN
PHOTOSYNTHETIC TISSUE
MESOPHYLL PHOTOSYNTHETIC TISSUE
CHLOROPLAST
CHLOROPLAST
CHLOROPLAST

SITE: PHOTOSYNTHESIS

CHLOROPLAST
CHLOROPLAST ULTRASTRUCTURE
CHLOROPLAST ULTRASTRUCTURE

CHLOROPLAST

ULTRASTRUCTURE

STROMA

DOUBLE MEMBRANE

GRANUM

THYLAKOID

VESICLES

THYLAKOID MEMBRANE
CHLOROPLAST ULTRASTRUCTURE

DOUBLE MEMBRANE

STROMA

THYLAKOID

THYLAKOID MEMBRANE

GRANUM

VESICLES
THYLAKOID MEMBRANE
THYLAKOID MEMBRANE

CHLOROPLAST

PIGMENTED INNERMOST MEMBRANE

THYLAKOID MEMBRANE
CHLOROPLAST ULTRASTRUCTURE

DOUBLE MEMBRANE

THYLAKOID MEMBRANE

STROMA

GRANUM

THYLAKOID VESICLES
THYLAKOID VESICLES
THYLAKOID VESICLES

COMPRISE
THYLAKOID MEMBRANE

THYLAKOID VESICLES
CHLOROPLAST
ULTRASTRUCTURE

DOUBLE MEMBRANE

THYLAKOID VESICLES

THYLAKOID MEMBRANE
THYLAKOID
GRANUM / GRANA
THYLAKOID GRANUM

STACKED THYLAKOID VESICLES

THYLAKOID GRANUM
THYLAKOID GRANUM

STACKED

THYLAKOID VESICLES

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SITE: LIGHT RXT

THYLAKOID GRANUM
THYLAKOID GRANUM

STACKED

THYLAKOID VESICLES

---

SITE: LIGHT RXT

DERIVES ATP

THYLAKOID GRANUM
CHLOROPLAST ULTRASTRUCTURE

DOUBLE MEMBRANE

GRANUM

THYLAKOID VESICLES

THYLAKOID MEMBRANE
PHOTOSYNTHESIS

LIGHT REACTION
PHOTOSYNTHESIS

LT RXT
THYLAKOID
GRANUM

CHLOROPLAST
PHOTOSYNTHESIS

LIGHT EGY

LT RXT

THYLAKOID

GRANUM

CHLOROPLAST
PHOTOSYNTHESIS

LIGHT EGY

WATER

PHOTOLYSIS

ELECTRON

LT RXT

THYLAKOID GRANUM

P + ADP → ATP

CHEMICAL ENERGY

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL ENERGY INPUT
PHOTOSYNTHESIS

LIGHT EGY

WATER

E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN
STROMA
STROMA

CHLOROPLAST
FLUID MATRIX

STROMA
STROMA

CHLOROPLAST

FLUID MATRIX

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SITE: DARK RXT
DERIVES GLUCOSE

STROMA
CHLOROPLAST ULTRASTRUCTURE

- **STROMA**
- **DOUBLE MEMBRANE**
- **GRANUM**
- **THYLAKOID VESICLES**
- **THYLAKOID MEMBRANE**
PHOTOSYNTHESIS

DARK REACTION
PHOTOSYNTHESIS

LIGHT EGY

WATER

PHOTOLYSIS

E-

LT RXT

THYLAKOID GRANUM

ATP

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN
PHOTOSYNTHESIS

WATER

LIGHT EGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

ATP

DK RXT

STROMA ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN
PHOTOSYNTHESIS

LIGHT ENERGY

WATER

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

ATMOSPHERE

ATMOSPHERE

CO2

ATP

DK RXT

STROMA ENZYMES

OXYGEN

CHLOROPLAST
PHOTOSYNTHESIS

LIGHT EGY

WATER

LT RXT

THYLAKOID GRANUM

E-

PHOTOLYSIS

OXYGEN

ATTP

DK RXT

STROMA ENZYMES

CO2

ATMOSPHERE

CHLOROPLAST

ATMOSPHERE
PHOTOSYNTHESIS

PHOTOSYNTHESIS involves the process where light energy is converted into chemical energy in the form of glucose. It occurs in the chloroplasts of plant cells. The light energy is captured by pigments, primarily chlorophyll, which is located in the thylakoid membranes of the chloroplasts. This light energy is used to split water molecules into oxygen and protons, a process known as photolysis. The oxygen is released into the atmosphere, while the protons and electrons are used to generate ATP and NADPH, which are the energy currency of the cell. These energy-rich molecules, along with carbon dioxide from the atmosphere, are then used in the Calvin cycle to synthesize glucose.
LIGHT ENERGY
QUESTION
WHAT IS THE SOURCE OF THE LIGHT ENERGY?
QUESTION
LIGHT ENERGY SOURCE

SUN / STAR
SOLAR FUSION REACTIONS
SOLAR FUSION REACTIONS
HEAT

HYDROGEN FUSION REACTIONS

PRESSURE

SUN / STAR
HYDROGEN FUSION REACTIONS

HELIUM

SUN / STAR
HYDROGEN FUSION REACTIONS

HELUM

HEAT

SUN / STAR
HYDROGEN FUSION REACTIONS

HELIUM
HEAT
EM-EGY

SUN / STAR
HYDROGEN FUSION REACTIONS

HELIUM

HEAT

EM-EGY

DISSIPATES INTO SPACE

SUN / STAR
HYDROGEN FUSION REACTIONS

- HEAT
- HELIUM
- EM-EGY

DISSIPATES INTO SPACE

EARTH
ELECTROMAGNETIC ENERGY

EARTH
HYDROGEN FUSION REACTIONS

HELIUM

HEAT

EM-EGY

DISSIPATES INTO SPACE

EARTH
ELECTROMAGNETIC ENERGY
ELECTROMAGNETIC ENERGY
(RADIATION)
ELECTROMAGNETIC RADIATION

CONSISTS PHOTONS

ELECTROMAGNETIC RADIATION
PHOTON
PHOTON

UNIT

ELECTROMAGNETIC

ENERGY

PHOTON
EARTH

ELECTROMAGNETIC ENERGY

PHOTONS

EARTH
ELECTROMAGNETIC ENERGY
SPECTRUM
ELECTROMAGNETIC SPECTRUM

PHOTONS

HIGH ENERGY

LOW ENERGY

SHORT WAVELENGTH

LONG WAVELENGTH

EARTH
ELECTROMAGNETIC SPECTRUM

HYDROGEN FUSION REACTIONS

HYDROGEN FUSION REACTIONS

Earth
ELECTROMAGNETIC SPECTRUM

PHOTONS

HIGH ENERGY

Gamma rays  X rays  Ultraviolet  Visible  Near infrared  Infrared  Radio waves

SHORT WAVELENGTH

LOW ENERGY

EARTH

HYDROGEN FUSION REACTIONS

*
ELECTROMAGNETIC SPECTRUM

HIGH ENERGY

SHORT WAVELENGTH

LOW ENERGY

LONG WAVELENGTH

HYDROGEN FUSION REACTIONS

ELECTROMAGNETIC SPECTRUM PHOTONS

Gamma rays | X rays | Ultraviolet | Visible | Near infrared | Infrared | Radio waves

EARTH
ELECTROMAGNETIC SPECTRUM

HIGH ENERGY

PHOTOSYNTHESIS

PHOTONS

LONG WAVELENGTH

EARTH

LOW ENERGY

PHOTOSYNTHESIS

HYDROGEN FUSION REACTIONS

PHOTOSYNTHESIS

Gamma rays | X rays | Ultraviolet | Visible | Near infrared | Infrared | Radio waves

SHORT WAVELENGTH

PHOTOSYNTHESIS

HYDROGEN FUSION REACTIONS
PLANTS CONVERT VISIBLE LT EGY → CHEM EGY VIA PHOTOSYNTHESIS
PHOTOSYNTHESIS
SUMMARY
PHOTOSYNTHESIS

LEAF

PRINCIPLE

PHOTOSYNTHETIC

ORGAN
CHLOROPLAST ULTRASTRUCTURE

- STROMA
- DOUBLE MEMBRANE
- GRANUM
- THYLAKOID VESICLES
- THYLAKOID MEMBRANE
PHOTOSYNTHESIS

VISIBLE LIGHT ENERGY
PHOTOSYNTHESIS EQUATION
PHOTOSYNTHESIS

EQUATION

6CO2
PHOTOSYNTHESIS EQUATION

$6\text{CO}_2 + 12\text{H}_2\text{O}$
Photosynthesis Equation

\[ 6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{LT EGY} \]

Photosynthesis Equation
Photosynthesis Equation

$6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6$
PHOTOSYNTHESIS EQUATION

6\text{CO}_2 + 12\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_12\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2

CHLOROPLAST

LT EGY

CHEM EGY INPUT
PHOTOSYNTHESIS

LIGHT EGY

WATER

PHOTO

E-

PHOTOLYSIS

ATMOSPHERE

CHLOROPLAST

ATMOSPHERE

SYNTHESIS

ATP

GLUCOSE

OXYGEN

CO2

CHEMICAL ENERGY INPUT
PHOTOSYNTHESIS

LIGHT EGY

WATER

PHOTO

CO2

ATMOSPHERE

LT RXT

THYLAKOID

E-

PHOTOLYSIS

ATP

SYNTHESIS

? 

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE

ATMOSPHERE

CHEMICAL ENERGY INPUT
LIGHT REACTION & DARK REACTION
LIGHT
REACTION
OVERVIEW