What is Photosynthesis?

Photosynthesis is a process that ______________ energy from sunlight to make ___________ used as __________ for producers. The light energy is ____________________________________________________________________ in the sugars.
What is Photosynthesis?

• Autotrophs (producers) use __________ __________ to build ________________.

Organisms that can perform photosynthesis:

______________, ____________ and some ____________
Where does it occur in the cell?

Occurs in the _____________ of a cell
The Chloroplast

• Contains Chlorophyll, a _______________ that __________________________ from the sun.

• Grana: within the chloroplast. Stacks of

• ________________.

• Thylakoid: Membrane “sacs” that contain the ________________.

• Stroma: ________________ filled space that surrounds the ________________.
Membranes of the thylakoids contain **chlorophyll**.

Absorbs most light; reflects ____________ (and ________ ) light (this is why we see it as __________ ).

Plants have other photosynthetic pigments: _________________
These are not green so they absorb and reflect other spectrums of light. They are less abundant so they get masked by chlorophyll making leaves look ____________.

Xanthophyll

Carotene
Chlorophyll

Green (and yellow) light are Reflected.
What is the overall Photosynthesis Reaction?

\[ \text{Water} + \text{Carbon Dioxide} \rightarrow \text{Glucose} + \text{Oxygen} \]

- Absorbed by the roots
- Taken into the leaf
- Some released into the atmosphere
- Transferred to all parts of the plant
Steps of Photosynthesis

- **STEP 1** is the LIGHT REACTION
  - The “________” part; ________ is required
  - Occurs in the ________ of a chloroplast.
  - Chlorophyll ________
  - Light energy.
STEP 2: CALVIN CYCLE
The light _____________ Reaction or “Dark Reaction”.
The “_______________” part of photosynthesis; _________________ is made.
Occurs in the _______________ of the chloroplast.
Step 1: Light Reaction Detail

- Light energy causes chlorophyll electrons to get _______ and gain __________.

- The electrons _______ energy which is used to perform the following:
  - _________ : $2 \text{H}_2\text{O} \rightarrow 2\text{H}^+ + \text{O}_2$
  - _________ : ADP + P + energy from the e⁻
    Picked up by _______________ (an electron carrying molecule): $e^- + 2\text{H}^+ + \text{NADP} \rightarrow \text{NADPH} + \text{H}^+$ (The electron carrier)
Step 1: Light Reaction
Step 1: Light Reaction

- Used:
- 
- 

- Produced:
- 
- 
-
Step 2: Calvin Cycle Detail

• From the Light reaction comes _________ _______ (from NADPH), _________, and _______.

• **Calvin Cycle**: CO$_2$ and H$^+$ are cycled through a series of ___________ with the help from ATP producing ______________ (C$_6$H$_{12}$O$_6$) which is used as food for the plant and has chemical energy stored in it.
Step 2: Calvin Cycle

Carbon Molecule Complex Continues Cycle

Calvin Cycle
(occurs in stroma of chloroplast)

Energized electrons & Hydrogen from NADPH

Energy from ATP

CO₂

ADP + P

To the Light Reaction

NADP Back
Step 2: Calvin Cycle

• _______ from the _______ ________ provides energy to _________ the cycle.

• Energy from __________ is stored in newly formed __________ bonds of __________.
Step 2: Calvin Cycle

Overview

• No ___________________________

• Used:
  _
  _
  _

• Produced:
  _
  _
  _
Reactants diffused into the chloroplast

Light

H₂O

CO₂

NADP⁺

ADP + P₁

ATP

NADPH

CALVIN CYCLE

[CH₂O] (sugar)

O₂

Chloroplast

Products leaving Chloroplast
Steps of Photosynthesis

\[ 6 \text{H}_2\text{O} + 6 \text{CO}_2 \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \]

(chlorophyll)

**Step 1: Light Reaction:**

Sunlight + H\(_2\)O → ATP + NADPH + O\(_2\)

**Step 2: Calvin Cycle (Dark Reaction):**

ATP + NADPH + CO\(_2\) → C\(_6\)H\(_{12}\)O\(_6\)
Review

• What is the purpose of photosynthesis?

• Write the overall balanced equation and circle the main product. Underline the waste product.
Review

• What is the purpose of the light reaction?

• What is the purpose of the Calvin Cycle?

• What is transferred from the Light Reaction to the Calvin Cycle?
Review

• If you put a plant in green light and blue light, what would you expect in terms of its growth?

• A) Both plants will not grow since white light is necessary.
• B) Plant in green would grow, plant in blue light would not.
• C) Plant in green would not grow, plant in blue would grow.
• D) Both would grow