

Lesson

SAT II

Chloroplast structure

Light Dependent & Independent Reactions

HONORS ONLY

Practice Questions

1) Which process is directly used by autotrophs to store energy in glucose?

(1) diffusion

(2) respiration

(3) photosynthesis

(4) active transport

2) What does the process of photosynthesis produce?

1) starch, which is metabolized into less complex molecules by dehydration synthesis

2) protein, which is metabolized into less complex molecules by dehydration synthesis

3) glycerol, which is metabolized into more complex carbohydrates by dehydration synthesis

4) glucose, which is metabolized into more complex carbohydrates by dehydration synthesis

Practice Questions

3) Which process provides most of the oxygen found in Earth's atmosphere?

1) photosynthesis

2) aerobic respiration

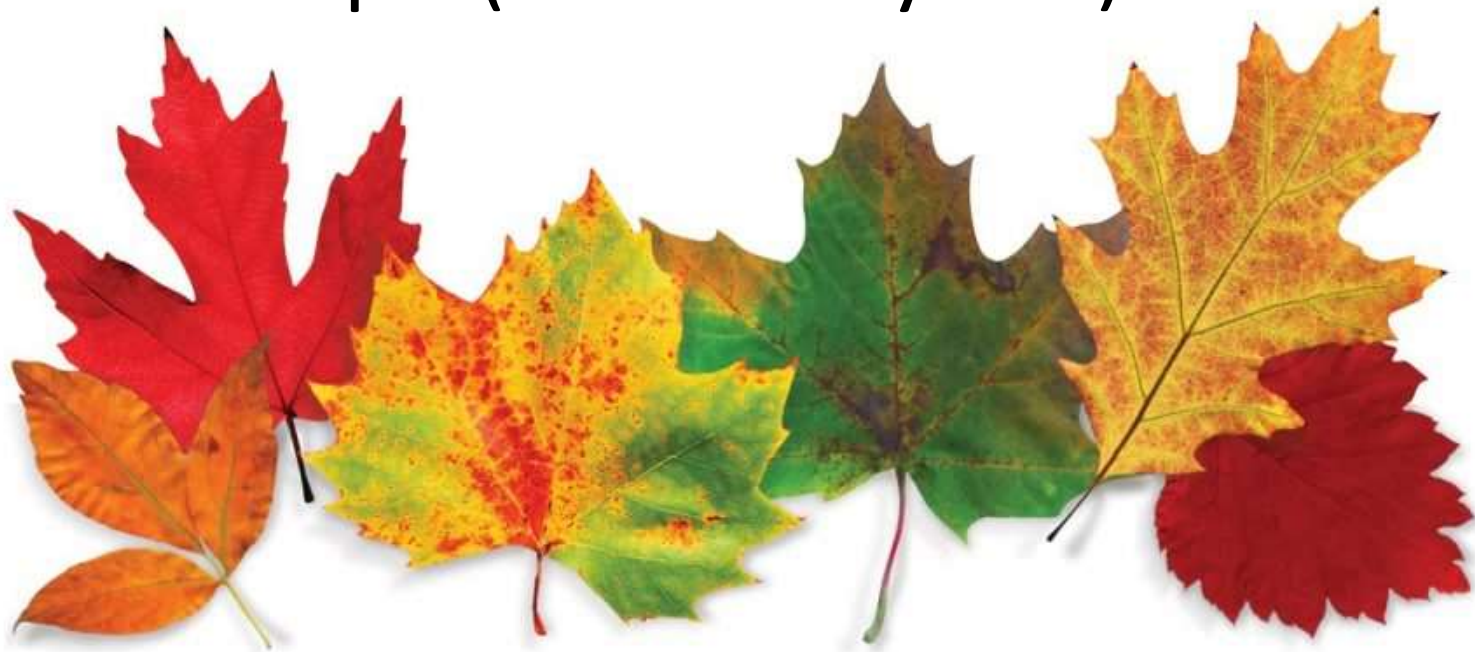
3) dehydration synthesis

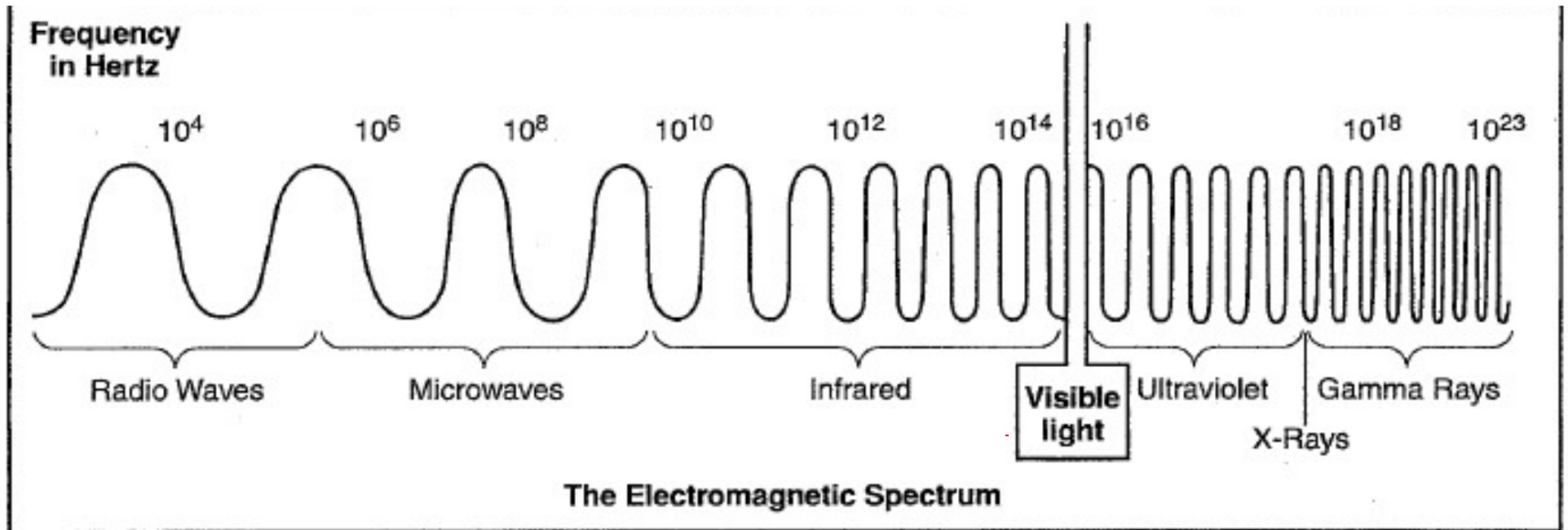
4) fermentation

- Transport, Nutrition, Regulation and Respiration are 4 of the life functions carried out by ALL living things! How does the leaf help to perform these processes in plants?
- In Greek, “stomata” means “mouth”...why do you think the holes in the bottom of the leaf are called *stomates*?

Factors that can affect the rate of photosynthesis

- Light (intensity, duration, color/wavelength)
- Availability of water
- Temperature & pH (affect enzymes)





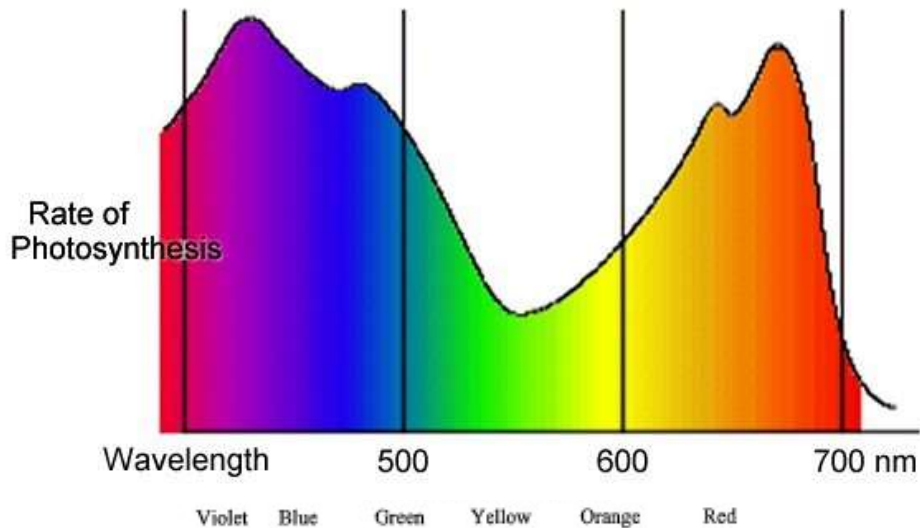
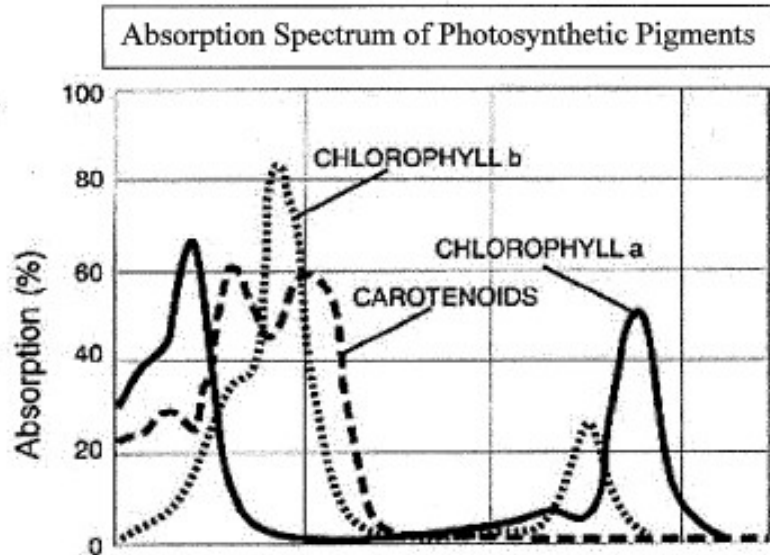
Evaluation Answer the following questions

1. What kind of electromagnetic waves have the longest wavelength? Which ones have the shortest?
2. Bees can see higher frequencies of electromagnetic waves than humans can. What type of electromagnetic radiation do you think bees can see that humans cannot? Explain your answer.

Longest = radio waves

shortest = gamma waves

ultraviolet light section of the spectrum



Analysis Questions:

1. Which pigment participates directly in the light dependent reactions?

Chlorophyll a

2. Which pigments are antennae or accessory pigments, assisting in photosynthesis?

Chlorophyll b, carotenoids, phycobilins

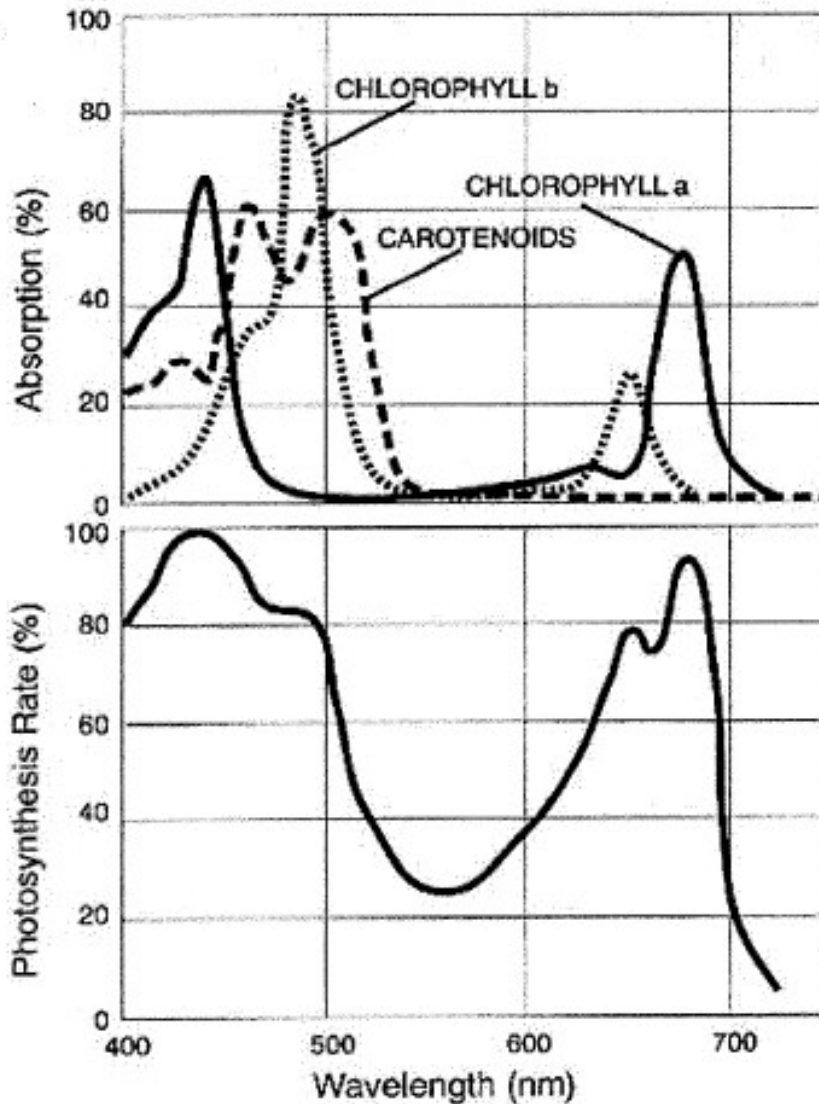
3. Why is chlorophyll green?

It absorbs all other wavelengths of light

4. Which wavelength (color) of light is *least* useful for photosynthesis? Why?

Green b/c it is reflected and not absorbed well by pigments

Absorption Spectrum of Photosynthetic Pigments

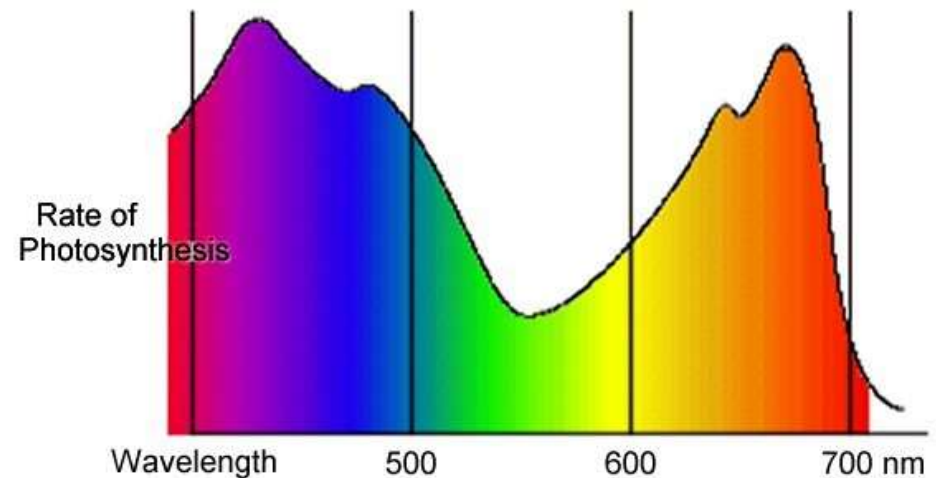


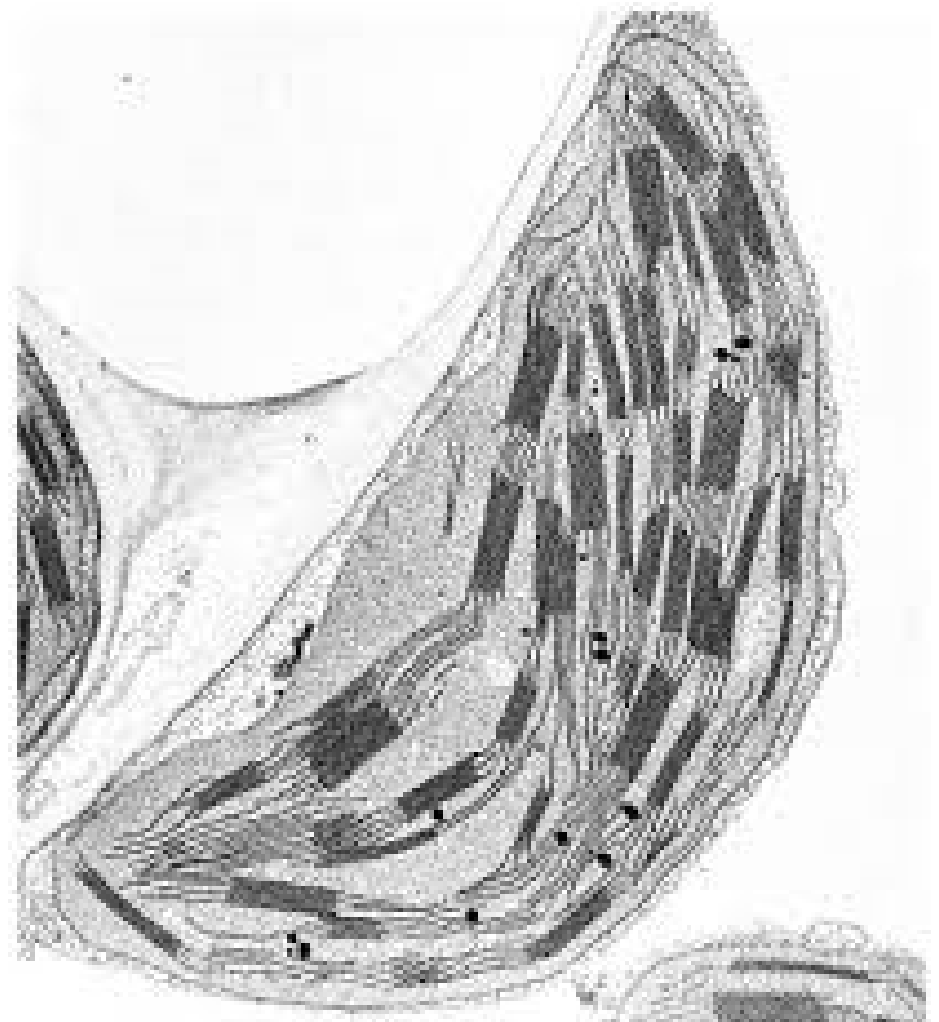
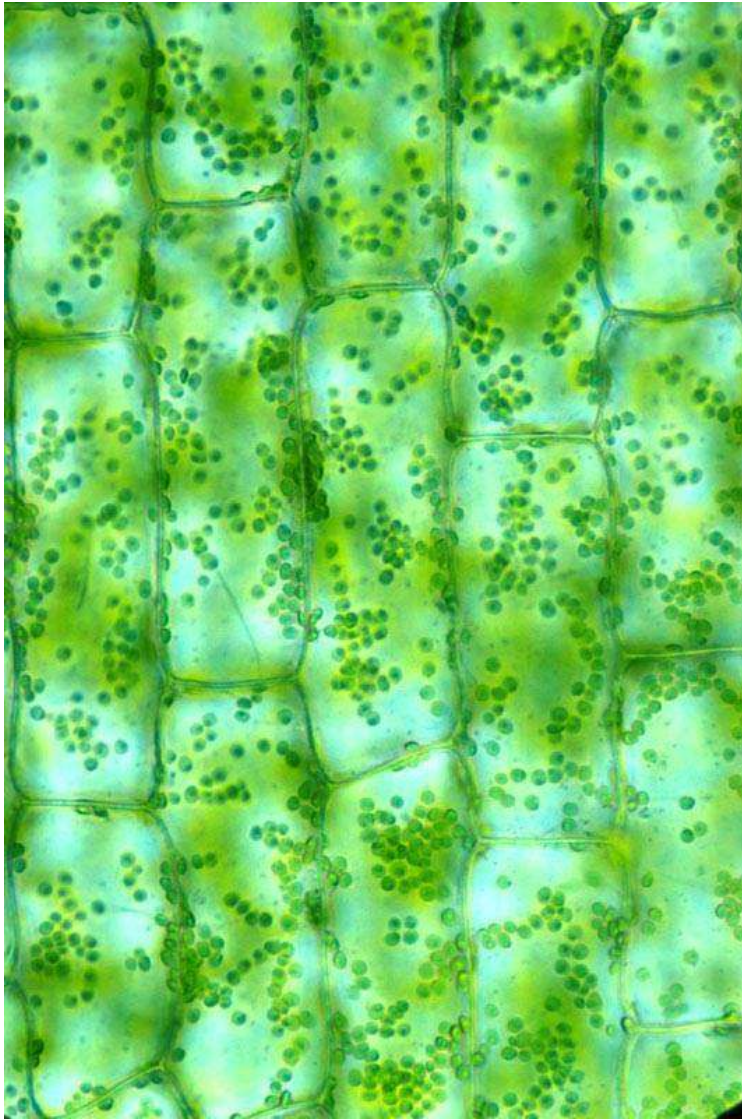
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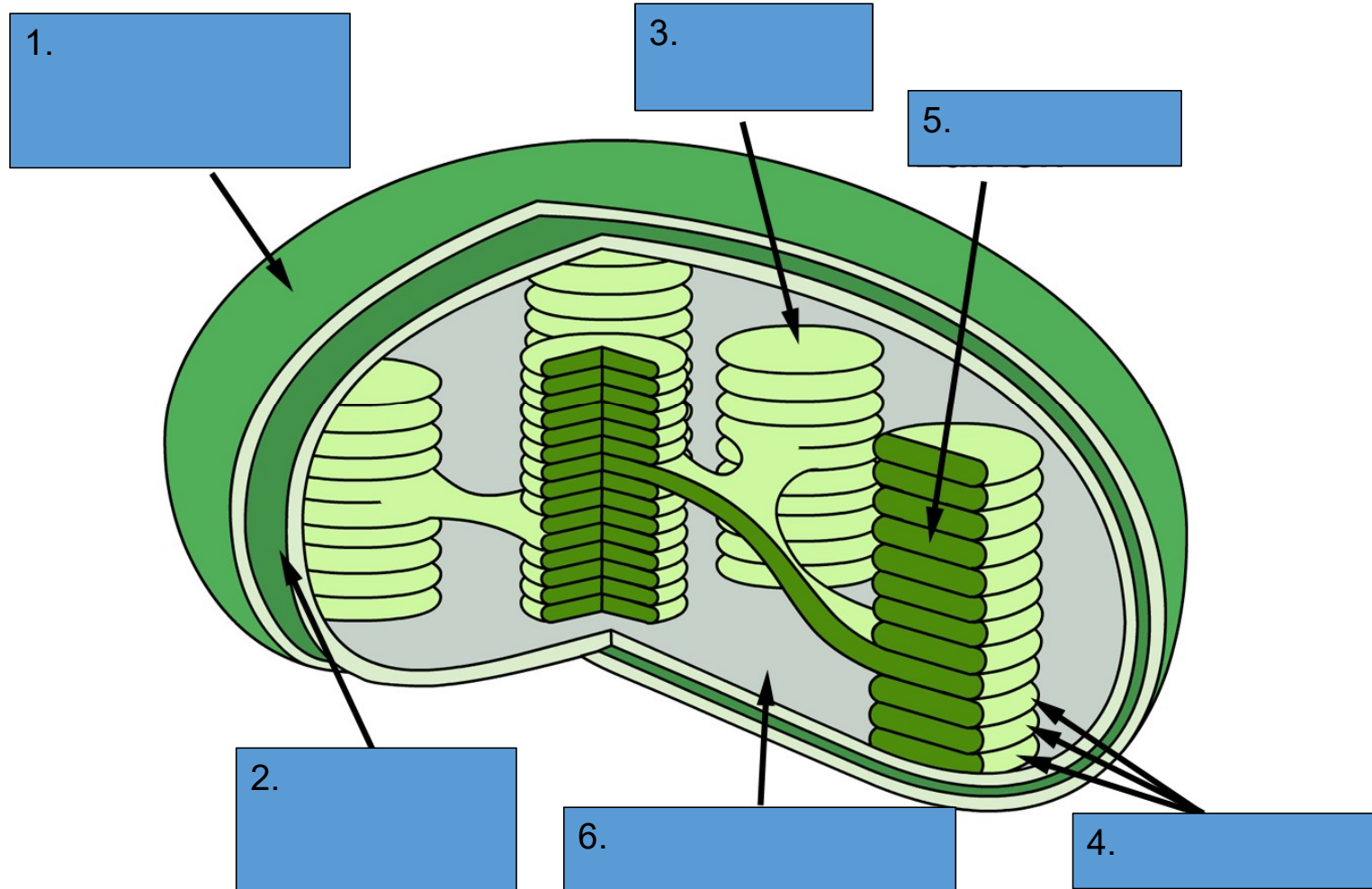




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Chloroplast Structure (draw a chloroplast)

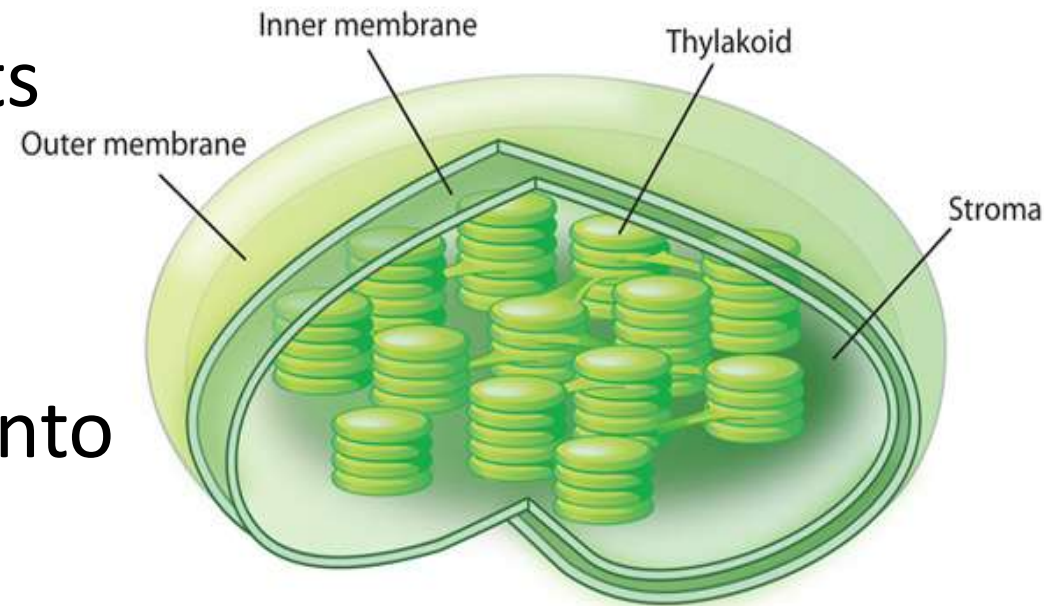
Draw a Chloroplast



2 Major Sets of Photosynthetic Reactions

1. Light Dependent Reactions

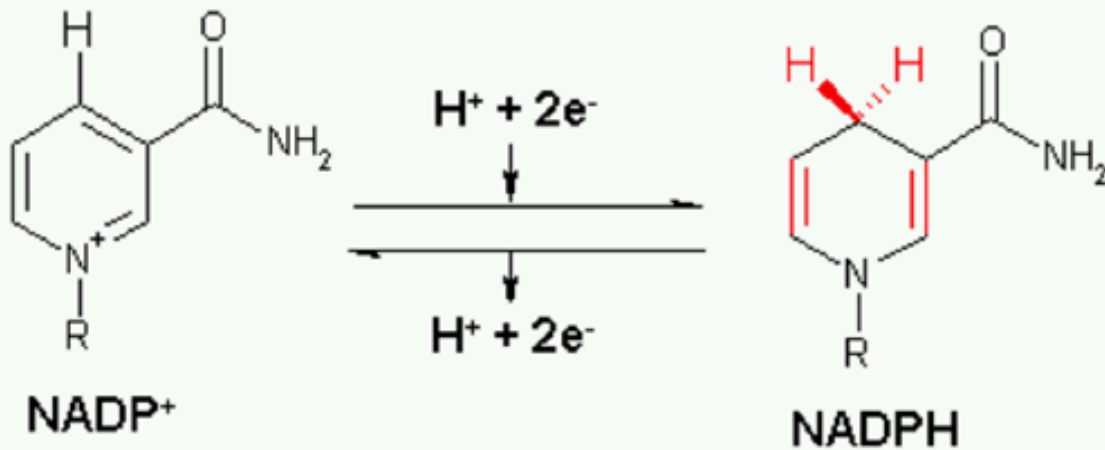
- Occurs on thylakoid membranes of chloroplasts
- Requires light
- Photolysis takes place, (light energy splits water into hydrogen atoms & O₂ gas)
- ATP and NADPH (an electron carrier molecule) are produced



Electron Carriers

- When electrons in chlorophyll absorb sunlight, the electrons gain a great deal of energy.
- Cells use **electron carriers** to transport these high-energy electrons from chlorophyll to other molecules.
- Example of electron carrier: **NADP⁺**
 - $\text{NADP}^+ + \text{H}^+ \rightarrow \text{NADPH}$

Electron Carrier Molecule



- picks up electrons from one molecule and drop them off with another

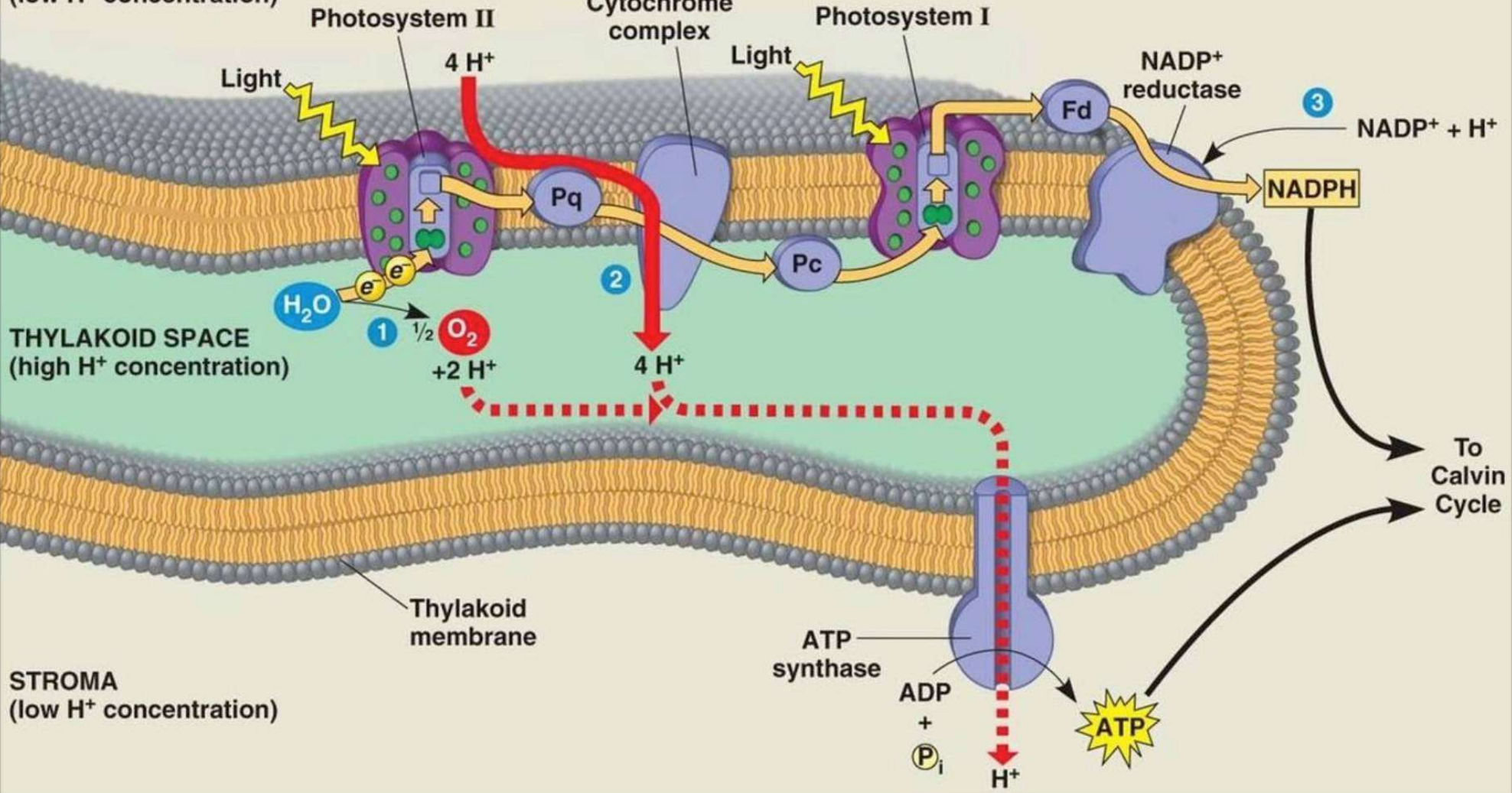
Ex. NADPH

nicotinamide adenine dinucleotide
phosphate hydrogen

NADP⁺ – Electron Carrier Molecule

- Electron Carrier Molecules
 - Compound that can accept a pair of high energy electrons and transfer them, along with most of their energy to another molecule
 - One way the sunlight can be trapped in a chemical form and use it to build glucose for the plant cell
 - *Example:*
 - **NADP⁺** = accepts and holds 2 high energy electrons along with a hydrogen ion (H⁺)
 - **When NADP⁺ accepts 2 electrons and a H⁺ it becomes NADPH**

STROMA
(low H^+ concentration)



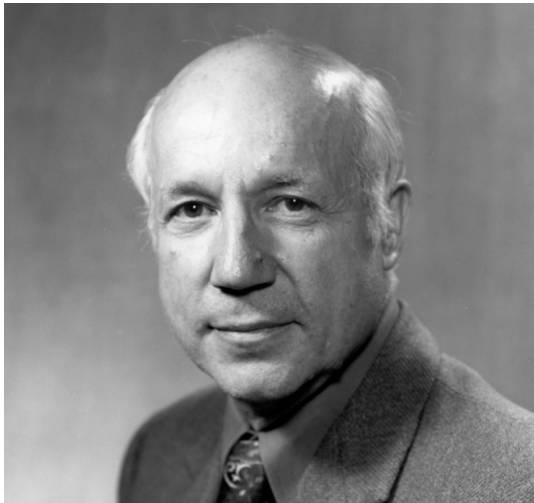
THYLAKOID SPACE
(high H^+ concentration)

STROMA
(low H^+ concentration)

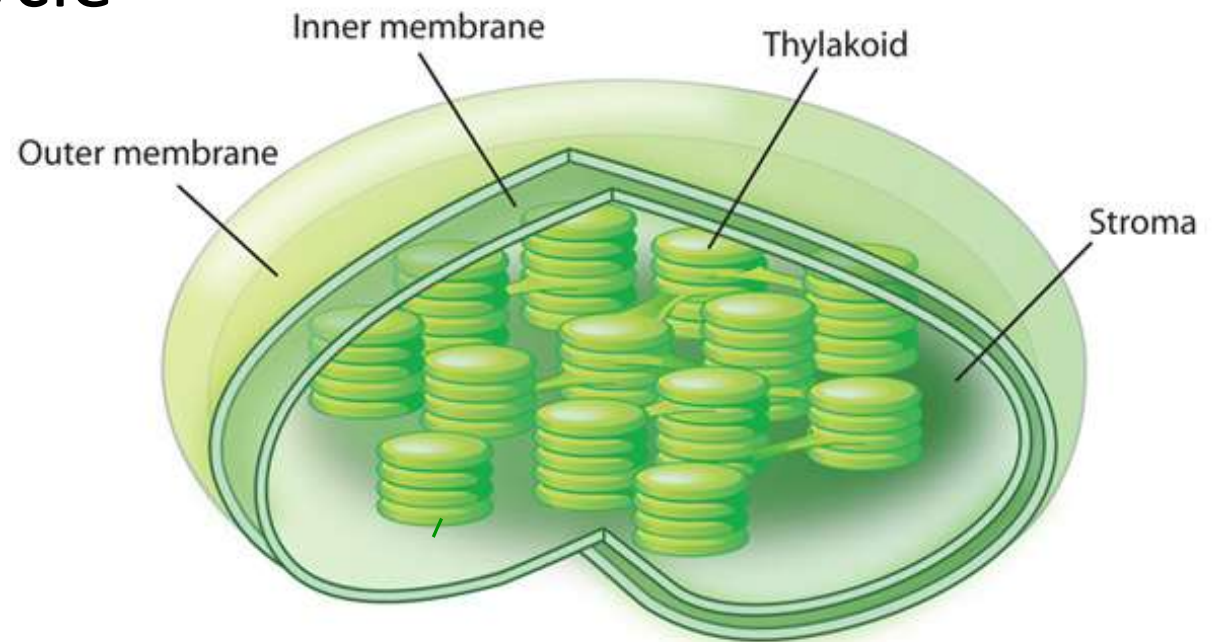
To Calvin Cycle

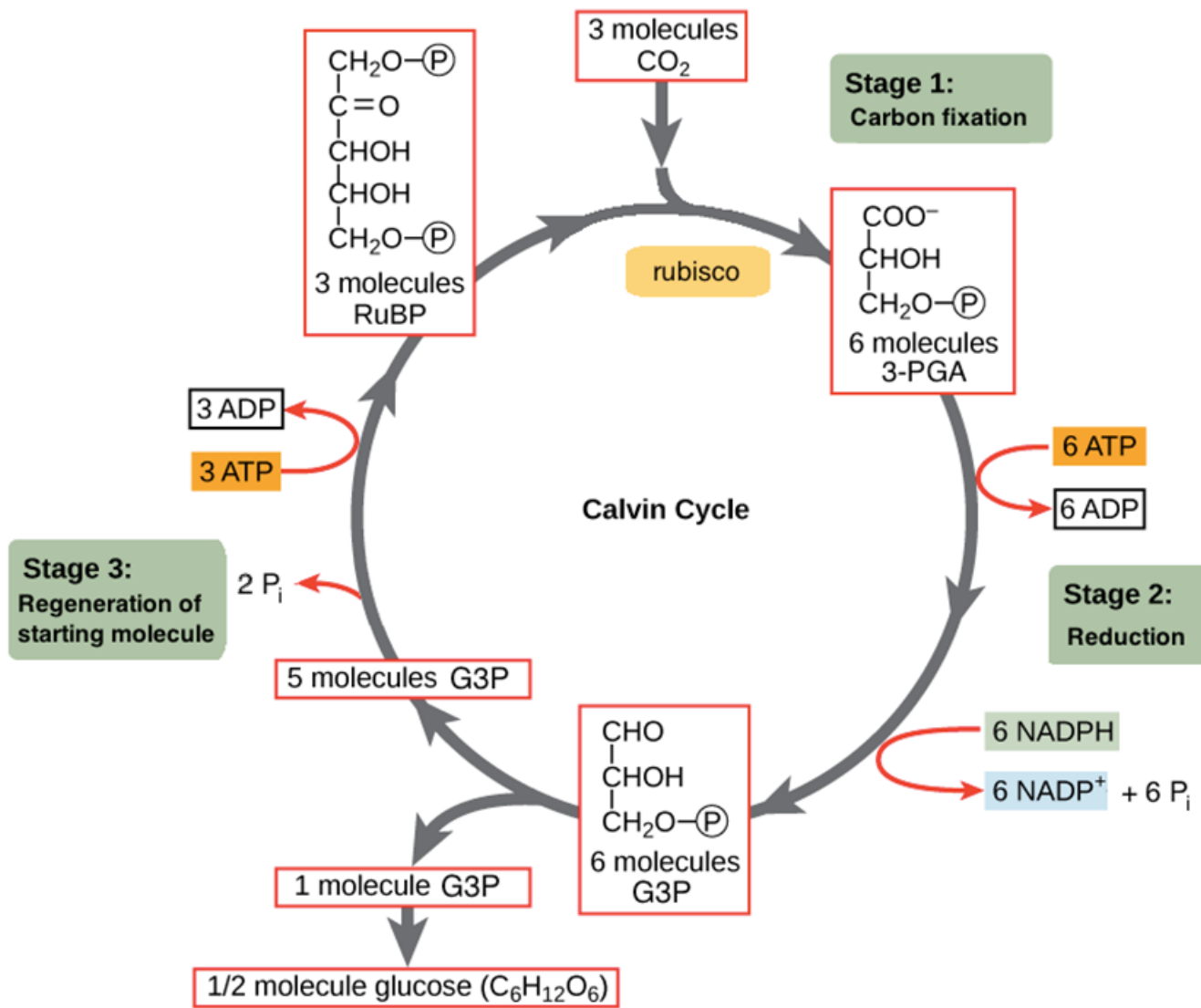
2. Light Independent Reactions (Carbon-Fixation)

- Occur in stroma of chloroplast
- Does not require light directly (but requires products of the 1st set of reactions)
- A.K.A. the Calvin cycle

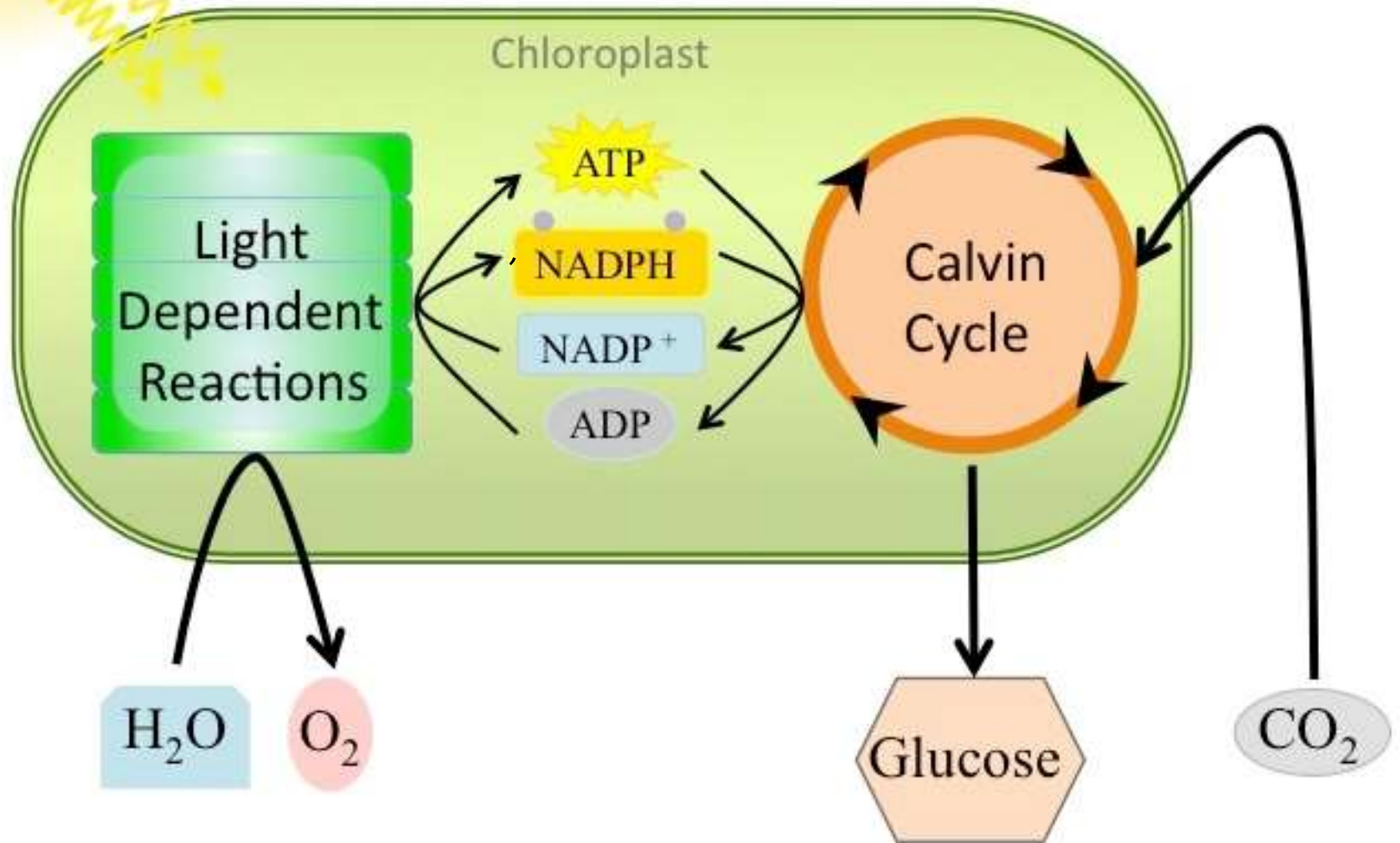


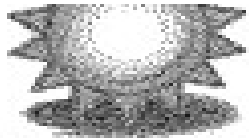
Melvin C. Calvin – Nobel Prize in Chemistry, 1961





Photosynthesis





Photosynthesis Reactions



[Amoeba Sisters Photosynthesis](#)

[Photosynthesis Reactions - YouTube](#)

	Light-Dependent Reactions	Light-Independent Reactions / Calvin Cycle
Main Function	Use light energy to produce ATP & NADPH (an electron carrier)	To make sugar called PGAL
Location	Thylakoid membranes of grana of chloroplast	Stroma of chloroplast
Occurs when?	Only in light	Only in light (though light is not required)
Reactants	Light Water ADP + P NADP ⁺	ATP NADPH Carbon dioxide
Products	Oxygen gas (waste) ATP NADPH	Sugar (PGAL) → glucose

Photosynthesis

