Name: Key DiStefano

PHOTOSYNTHESIS NOTES CHAPTER 8 Page 225

Energy is the ability to do work
Without the ability to obtain and use energy, life would cease to exist
All living things need energy; the usable form is called ATP

ATP = Adenosine Triphosphate

- Provides energy to living organisms
- ADP + P = ATP
- ATP can easily release and store energy by breaking and re-forming the bonds between its phosphate groups
- This makes ATP exceptionally useful as a basic energy source for all cells

HETEROTROPH	AUTOTROPH
An organism that obtain food by consuming other living things ***Types of Heterotrophs:*** Herbivore: eats plants only Omnivore: eats both plants & meat Carnivore: eats meat only Decomposer: absorb nutrients from decomposing organisms	Organism that make their own food **Examples** rose oak tree grass algae

Photosynthesis: the process where autotrophs convert the energy of sunlight into chemical energy stored in the bonds of carbohydrates

~Section 2 Photosynthesis Page 230~

- Energy from the sun travels to Earth in the form of light
- Our eyes see sunlight as white light which is actually a mixture of all wavelengths
- These wavelengths are visible to our eyes and make up the visible spectrum AKA the rainbow with the following colors: ROY G BIV

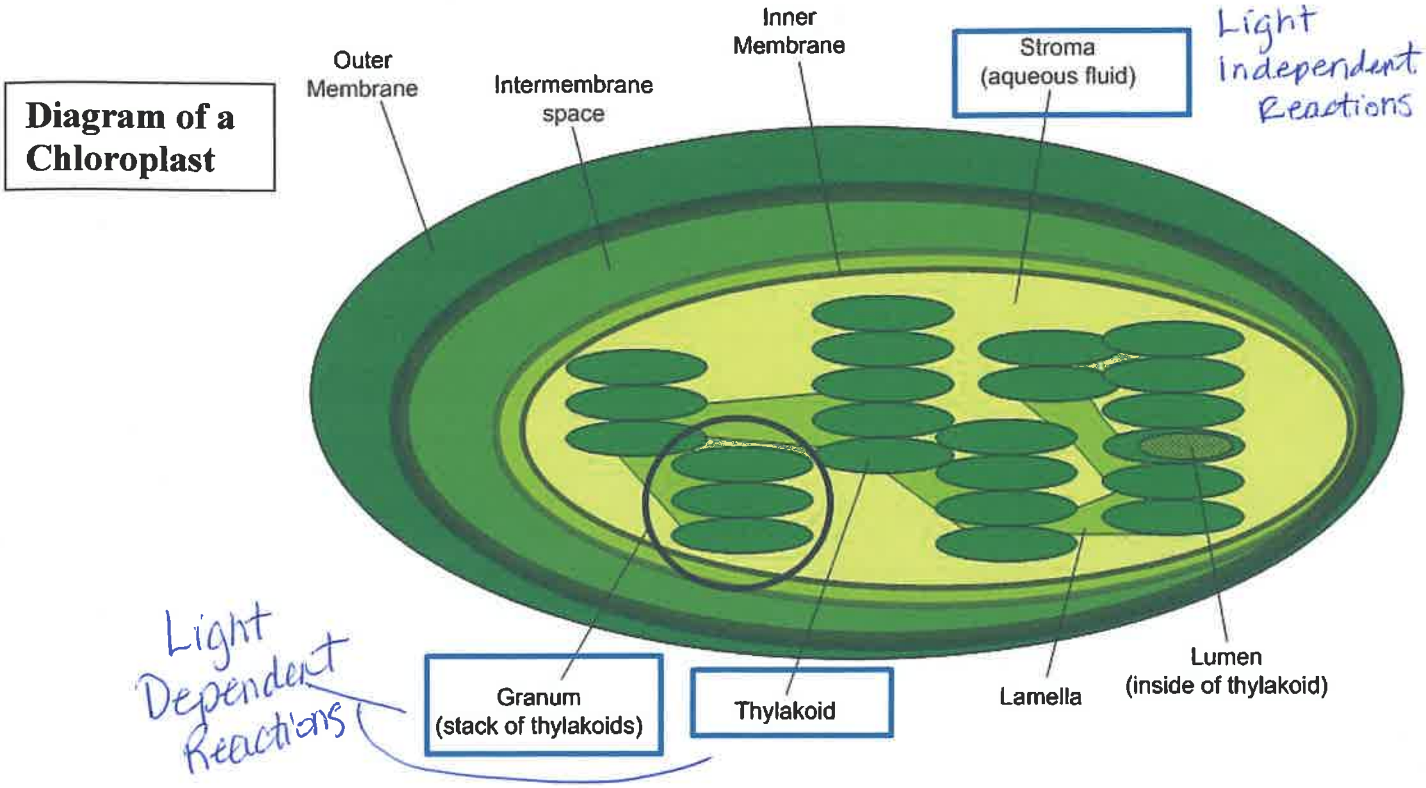
Pigments: light absorbing molecule

Primary pigment used in Photosynthesis:	**Secondary pigment** used in Photosynthesis called
Chlorophyll Types: a b Absorbed colors: roy iv Reflected colors: green Color actually seen: green	Carotene Absorbed colors: G BIV Reflected colors: ROY Color actually seen: red orange yellow Most of the time, the intense green color of chlorophyll overwhelms the accessory pigments so that you do not notice them - thus green leaves spring + summer

Photosynthesis takes place in the organelle: Chloroplast

Thylakoid : a sac-like photosynthetic membrane
Grana : thylakoids arranged in stacks
Stroma : the fluid portion outside of the thylakoid

Diagram of a Chloroplast



Why is Chlorophyll so important for Photosynthesis?

- absorbs energy from sun
- transferred to e^-
- this gives other high-energy e^- power to make photosynthesis work

Electron Carrier Molecules: a compound that can accept a pair of high energy electrons (e^-) and transfer them along with most of their energy (like tag)
An example: $NADP^+$ → NADPH

Write the chemical formula for Photosynthesis:

$6CO_2$ + $6H_2O$ $\xrightarrow{\text{light}}$ YIELDS $C_6H_{12}O_6$ + $6O_2$

Reactants= Carbon dioxide, Water, sunlight
Products= Sugars, Oxygen
↳ Glucose

Photosynthesis occurs in 2 phases

Phase 1= Light Dependent Reactions

- They require: light, chlorophyll, water
- Use energy from sunlight to produce ATP
- Occurs in the thylakoid of the chloroplast
- Water is required as a source of e⁻ & Hydrogen ions
- Product= oxygen

Phase 2= Light Independent Reactions

- Plants absorb Carbon dioxide (CO_2) from the atmosphere and complete photosynthesis by producing Carbohydrates
- ATP and NADPH from Phase 1 are used to produce sugars
- No light is needed
- Occurs in the stroma outside of the thylakoid in the chloroplast

Diagram of the
LIGHT DEPENDENT REACTIONS
&
LIGHT INDEPENDENT REACTIONS

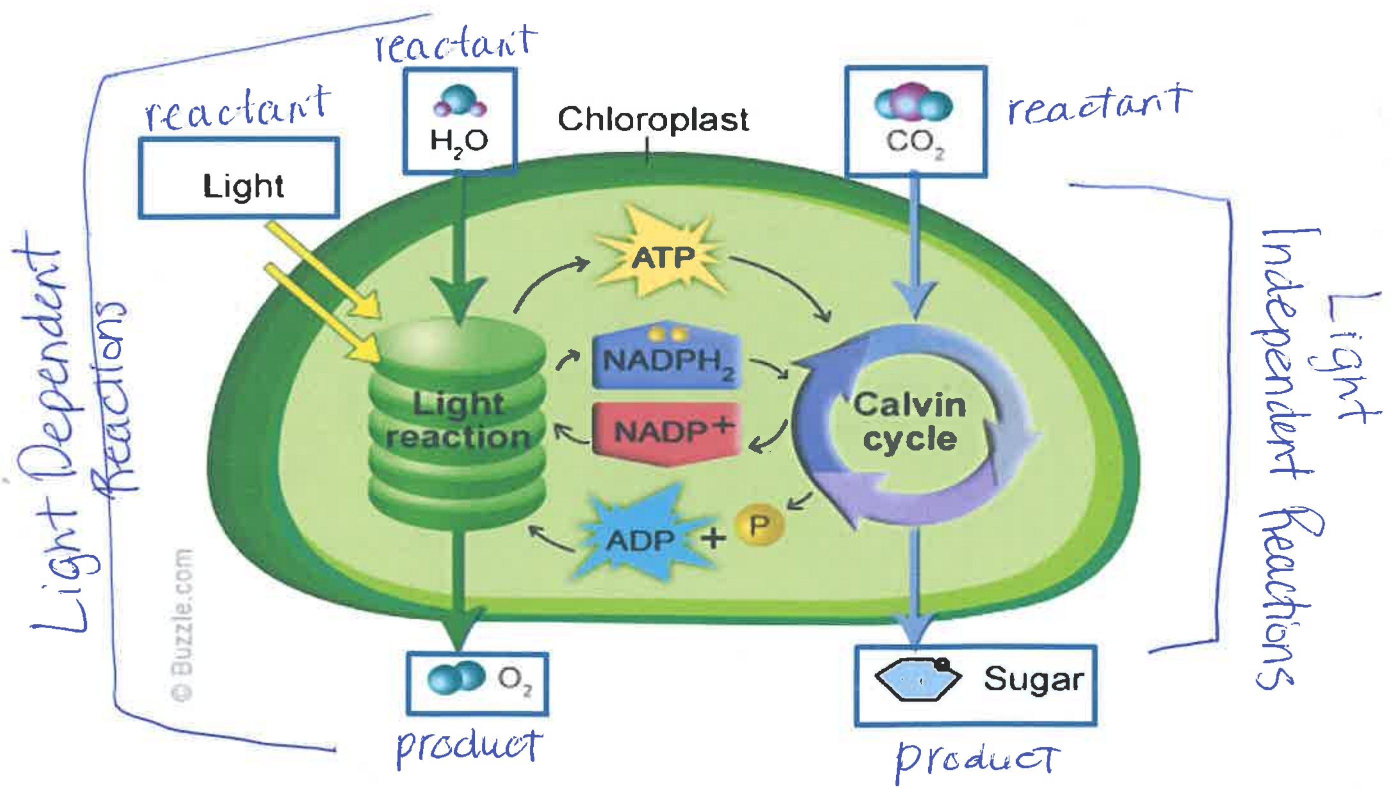
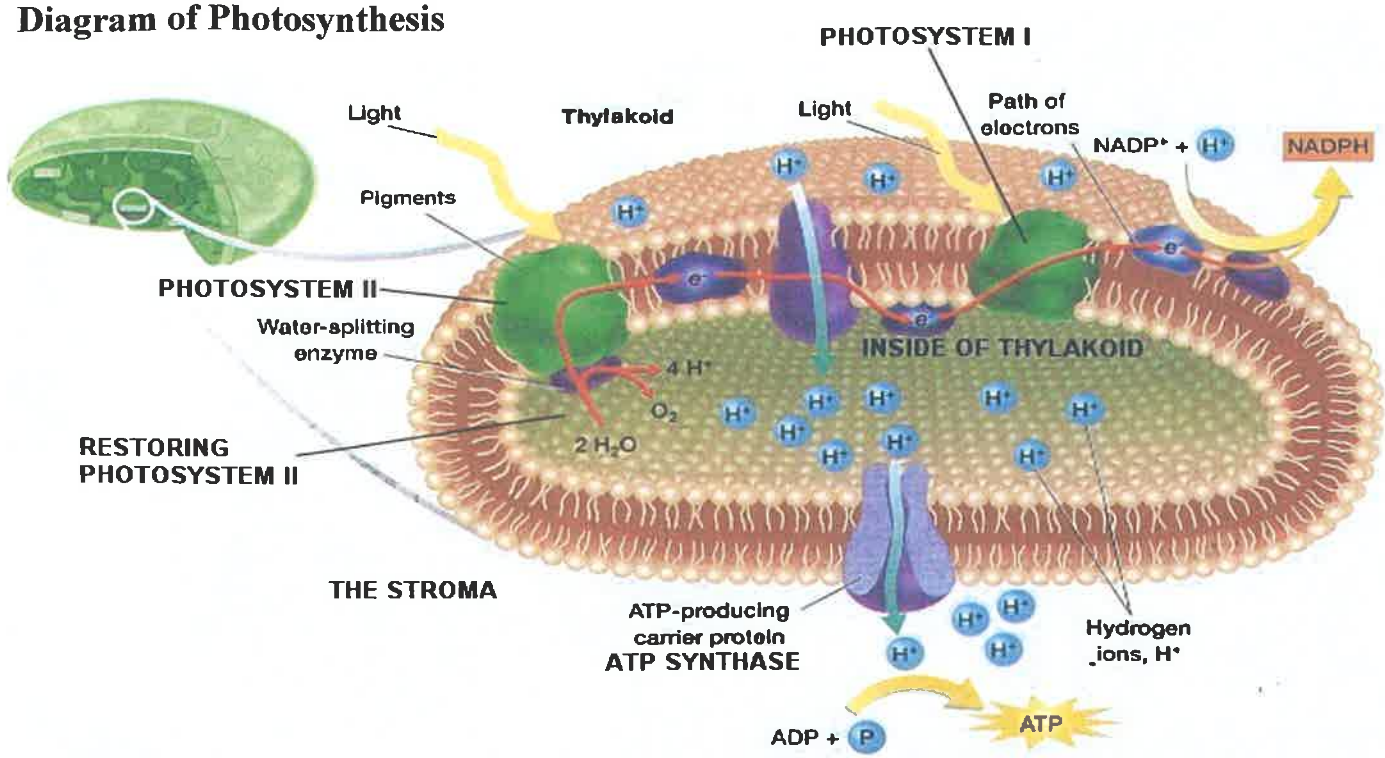


Diagram of Photosynthesis



Some extra info that we will fill in together

Light Dependent Reactions

Phase 1 = Light Reactions Steps

- The ___Chlorophyll___ in the thylakoid receives energy from the sun
- ___light___ energy is absorbed by the ___excited___ electrons
- These excited ___electrons___ cause even more to become ___excited___
- This excitement and jumping causes ___Water___ to be broken down
- ___Water___ is spilt into ___O___ (AKA ___oxygen___) and ___H+H___ (AKA ___excited e-___)
- ___Oxygen___ is given off as a gas

Part 2 of Phase 1 = Electron Transport Chain Steps

- The excited ___electrons___ accumulate in the ___thylakoid___
- A protein embedded in the ___thylakoid___ membrane acts like a ___pump___
- This pump will bring the ___excited e-___ in and out of the ___thylakoid membrane___
- As a result, ___ATP___ and ___NADPH___ are created
- These are ___energy carrier___ molecules will help to power the Light Independent reactions

Light Independent Reactions

Phase 2: The Calvin Cycle Steps

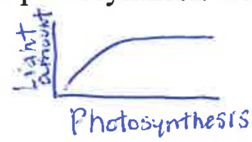
- Does not need ___Sunlight___ and occurs in the ___stroma___
- Called ___Calvin Cycle___ or ___Carbon dioxide fixation___
- ___ATP___ and ___NADPH___ provide the cells with large amounts of ___energy___ and help to power the ___Calvin___ Cycle
- This stage uses ___Carbon dioxide___ & the energy carrier molecules to help produce ___Carbohydrates___

At the **end** of PHOTOSYNTHESIS:

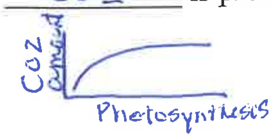
___Oxygen___ is produced & ___glucose (carbohydrates)___ is produced

Factors that will affect Photosynthesis

1. Sunlight
   - as light energy increases the rate of photosynthesis will also increase until the plant reaches its maximum level



2. Carbon dioxide
   - Once a certain amount of CO_2 is present, photosynthesis cannot proceed any further



3. Temperature
   - plants operate only within certain temperature ranges such as 0-35°C
   - Thus Increased temperature and photosynthesis does not work correctly
   - Thus Decreased temperature and photosynthesis does not work correctly

4. Water
   - Water is one of the reactants (raw materials)
   - A shortage of water can slow photosynthesis or even damage the plant
   - Some plants have adapted to overcome water loss (desert plants, conifers)

Alternative paths for plants that live in difficult environments:

C4 Plants	CAM Plants
Photosynthesis continues to work in low CO_2, high temperature & high light Ex: corn, sugar cane, sorghum	Photosynthesis continues despite hot, dry climate by completing the Calvin Cycle only at night — breath only at night (Light Independent Reaction) Ex: desert plants - cacti, pineapple, ice plant