Name Wilmot Student Period _____

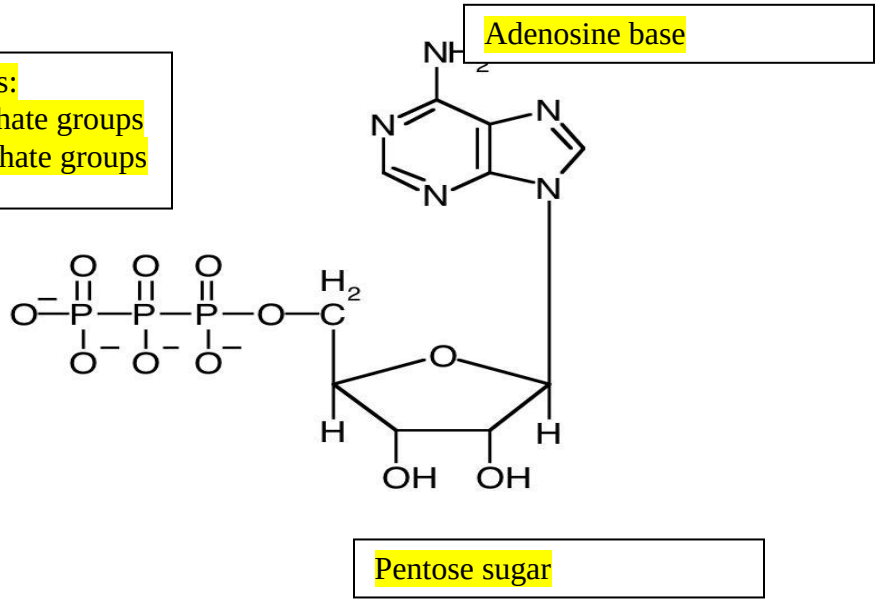
Photosynthesis and Cellular Respiration Study Guide

1.1 Energy for Life

1. Vocabulary to know:

A. ATP	energy-carrying molecule that cells use to power their metabolic processes
B. Autotroph/ Producer	organism that makes its own food
C. Cellular Respiration	process in which cells break down glucose and make ATP for energy
D. Energy	ability to do work
E. Glucose	simple carbohydrate with the chemical formula $C_6H_{12}O_6$ that is the nearly universal food for life
F. Heterotroph/ Consumer	organism that consumes other organisms for food
G. Photosynthesis	process of using the energy in sunlight to make food (glucose)

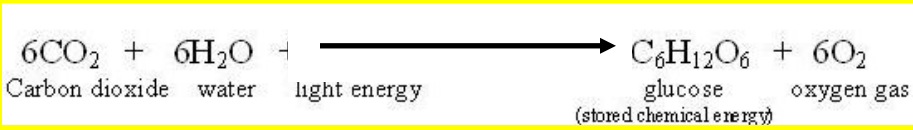
2. How do autotrophs and heterotrophs obtain their energy?
   Auto→ make own food directly from sunlight
   Hetero→ consume others for energy
   Hetero depend on Auto
   Hetero would die out without Auto
3. What is the ultimate source of all energy?
   Sunlight
4. Recognize the components of an ADP and ATP molecule (refer to your packet).
   Adenosine base, pentose sugar and the phosphate groups in the ATP molecule below.



5. Be able to explain how energy is released from ATP, what happens to release the energy?
   Break chemical bond between 2 phosphate groups and reduce to ADP; released energy used for biological processes of cells (active transport, movement within the cell)

6. Known the equations for both photosynthesis and cellular respiration.

1. Photosynthesis: enzymes, chlorophyll



Organelle it happens in: __CHLOROPLASTS___

Stores energy Releases energy (Circle one)

2. Cellular Respiration:

$C_6H_{12}O_6 + 6O_2$ ----------→ $6CO_2 + 6H_2O$ + energy

Organelle it happens in: __MITOCHONDRIA____

Stores energy Releases energy (Circle one)

7. Know how to read an equation and differentiate between reactants and products.

REACTANTS -----→ PRODUCTS

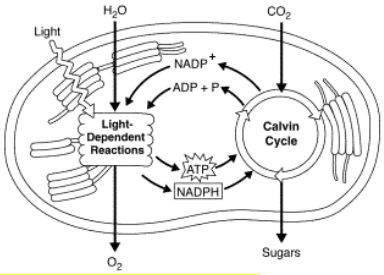
1.2 Photosynthesis: Sugar as Food

8. Vocabulary to know:

H. Calvin cycle (Light-Independent Reactions)	second stage of photosynthesis in which carbon atoms from carbon dioxide are combined, using the energy in ATP and NADPH, to make glucose
I. Chlorophyll	green pigment in a chloroplast that absorbs sunlight in the light reactions of photosynthesis
J. Chloroplasts	Organelle in the cell in which the process of photosynthesis takes place
K. Electron Transport Chain	series of electron-transport molecules that pass high-energy electrons from molecule to molecule and capture their energy
L. Light-Dependent reactions	first stage of photosynthesis in which light energy from the sun is captured and changed into chemical energy that is stored in ATP and NADPH
M. Stoma	Pores on the surface of leaves that allow water to be released during transpiration
N. Stroma	space outside the thylakoid membranes of a chloroplast where the Calvin cycle of photosynthesis takes place
O. Thylakoid membrane	membrane in a chloroplast where the light reactions of photosynthesis occur

9. What does chlorophyll do?
   Capture the sun's energy
10. What wavelength colors does chlorophyll absorb and what wavelength colors does it reflect?
    Red and blue absorbed; green reflected
11. Where do you find photosystems I & II?
    In the thylakoid membrane; they resemble protein channels we studied in the cell membrane
12. What are the two stages of photosynthesis? Light Dependent Reaction, Calvin Cycle
13. Where do the light-dependent reactions take place? Thylakoids

14. Where do the light-independent reactions (Calvin cycle or Dark Reactions) take place?
    Stroma
15. Know all the reactants and products of the light-dependent reactions and the Calvin cycle.



Light –Dependent Reactions:

Energy Source: _light_____

Reactants: _H_2O_____

_$NADP^+$_____

_ADP + P_____

Products: __O_2_____

__NADPH_____

__ATP_____

Calvin Cycle:

Energy Source: ___ATP_____

Reactants: __CO_2_____

__NADPH_____

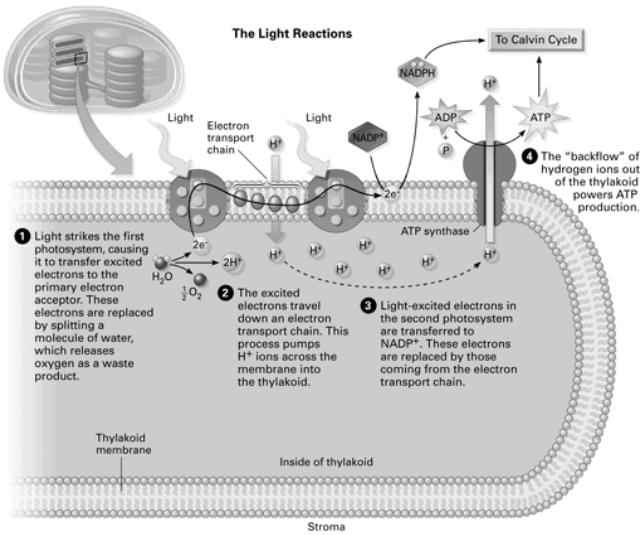
__ATP_____

Products: __Sugars_____

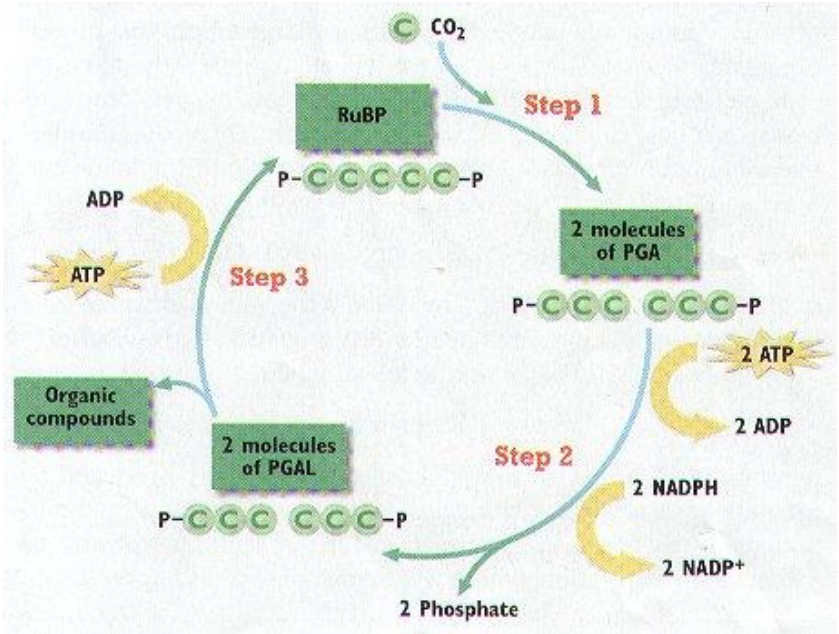
__ $NADP^+$_____

__ ADP + P _____

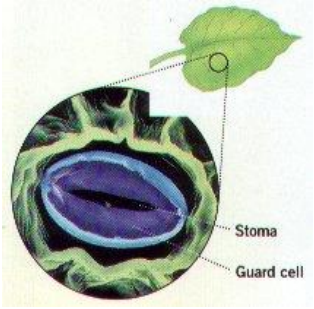
16. Know all the steps of the light-dependent reactions (refer to your packet; page 4).



1. Pigments (chlorophyll) in PSII and PSI absorb light
2. Water molecule is split=> O, H+ ions, and 2 e-
3. H+ create electrochemical gradient
4. e- move from PSII to PSI along electron transport chain
5. NADP+ converted to NADPH
6. e- re-energized
7. ADP converted into ATP in ATP synthase
8. ATP and NADPH go to Calvin cycle as reactants to provide an energy source

1. The gas Carbon Dioxide is used in the Calvin Cycle to make the sugar Glucose.
2. CO2 enters the cycle and is linked by the enzyme to a 5 Carbon sugar called RuBP. This produces an unstable 6 molecule Carbon molecule that very quickly splits into 2 3-Carbon molecules called PGA.
    a. Chemical work is then done by ATP and NADPH. During this process, 2 phosphate molecules are released and 2 molecules of PGAL are formed.
    b. Most PGAL is converted back to RuBP to keep the Calvin cycle going
    c. Some PGAL leaves the Calvin Cycle and is used to make other organic compounds including amino acids, lipids, and carbohydrates
    d. PGAL serves as the starting material for the synthesis of glucose and fructose
3. 

4. The energy for the Calvin cycle is ATP and NADPH made during the light reactions.
5. Most plants on Earth (80%) are known as C3 plants.
6. Know the three main factors that can affect the rate of photosynthesis. Temperature, Light, Water
7. Most plants on Earth (80%) are known as C3 plants.



8. C4 plants fix CO2 into 4-Carbon Compounds during the hottest part of the day when their stomata are partially closed
    a. C4 plants include corn, sugar cane and crabgrass
9. CAM plants include cactus & pineapples
    a. CAM plants open their stomata at night and close during the day so CO2 is fixed at night
    b. During the day, the CO2 is released from these compounds and enters the Calvin Cycle.