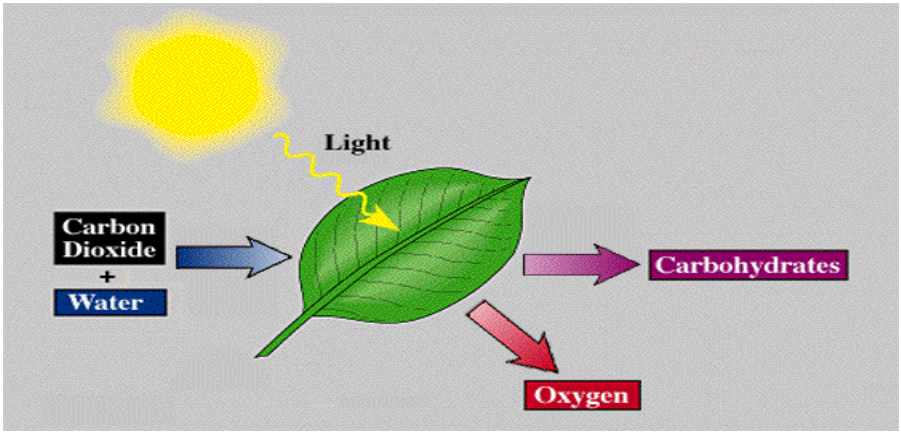


I. **Photosynthesis** ("photo" means "light")

1. Occurs in plants, some protists (algae), some bacteria (cyanobacteria)

2. In plants, occurs in **chloroplasts** found in plant leaves where **chlorophyll** (a pigment) absorbs light energy

3. Chemical Equation for Photosynthesis :

$$6CO_2 + 6H_2O + \text{sunlight} \rightarrow C_6H_{12}O_6 + 6O_2$$

carbon dioxide + water + light energy → glucose + oxygen

< reactants> → **<products>**

4. Factors affecting the rate of photosynthesis

a. amount of carbon dioxide

b. amount of light (winter vs. spring vs. summer)

c. amount of water

d. temperature (spring versus summer versus winter)

e. pH of soil (acidic versus basic)

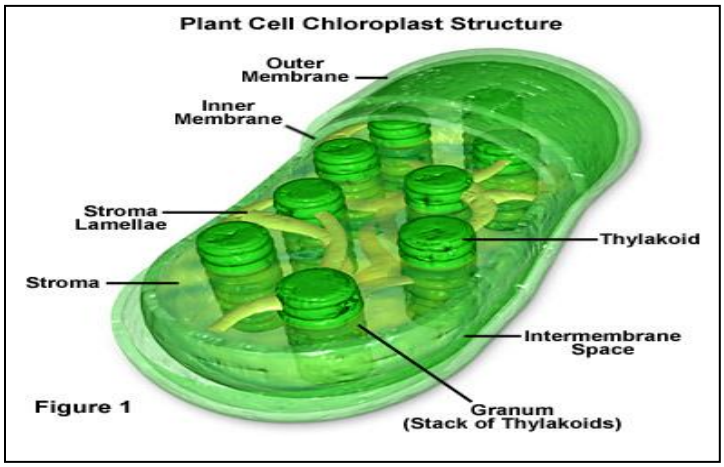
5. <u>chloroplast</u> : organelle in plant cells where photosynthesis occurs

Structure of chloroplast:

a. thylakoids are "cookie-like" membrane sacs in the chloroplast that contain chlorophyll (a stack of sacs is called a **granum**)

b. chlorophyll is a pigment in the chloroplast that absorbs the light

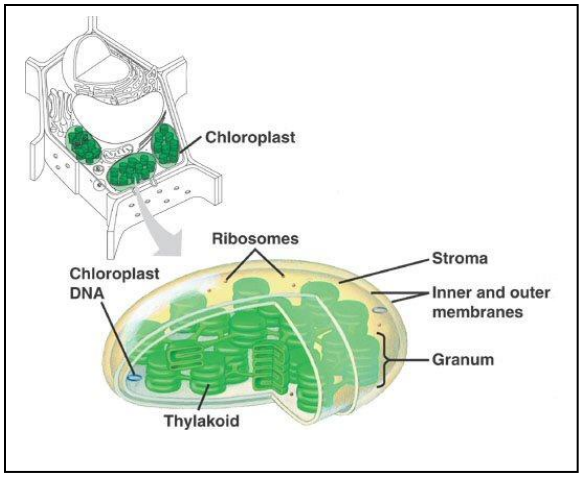
c. stroma is the liquid between the stacks

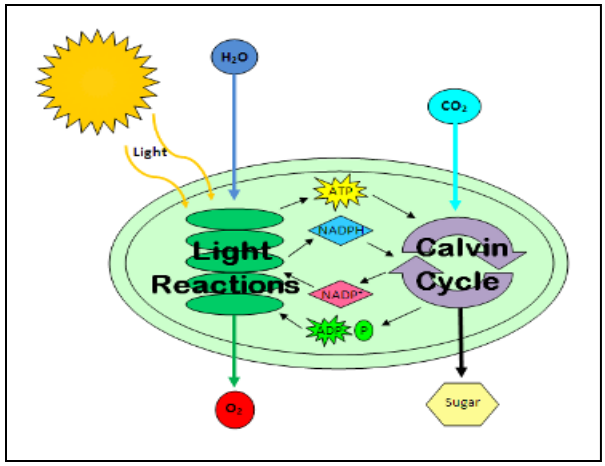


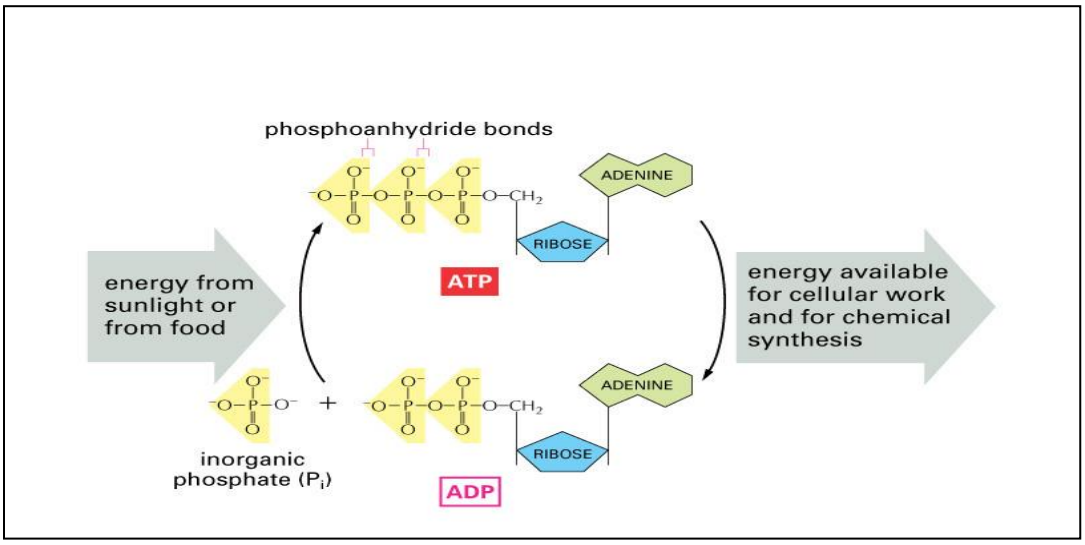
6. Steps of photosynthesis:

a. Light dependent reactions – Converts the photons of light energy into chemical energy of ATP to fuel the Calvin cycle

b. Light independent reactions (Calvin cycle) – Converts carbon dioxide gas into sugars by process of carbon fixation

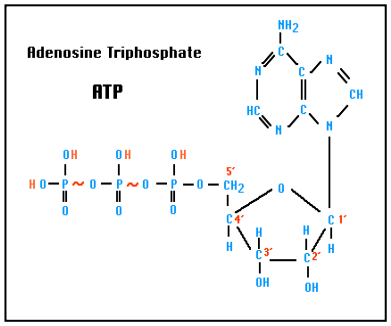






J. ATP – Chemical Energy in the Cell

1. ATP - Cellular energy made in the mitochondria via cellular respiration



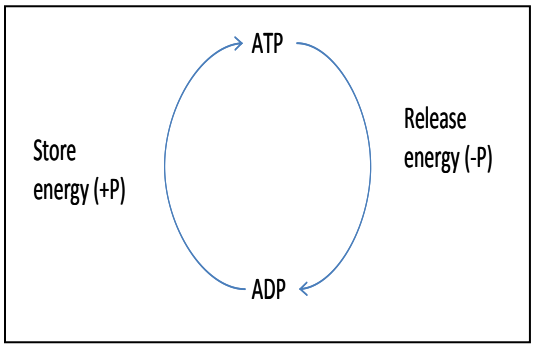
2. Adenosine **T**ri**P**hosphate –
ATP contains 3 phosphate groups

3. Energy is stored in the phosphate bonds of ATP

4. to use energy : break the phosphate bond,
this leaves ADP behind (adenosine **di**phosphate) with 2 phosphates

5. to store energy : make a phosphate bond by adding a phosphate to ADP making ATP

ATP Energy Cycle



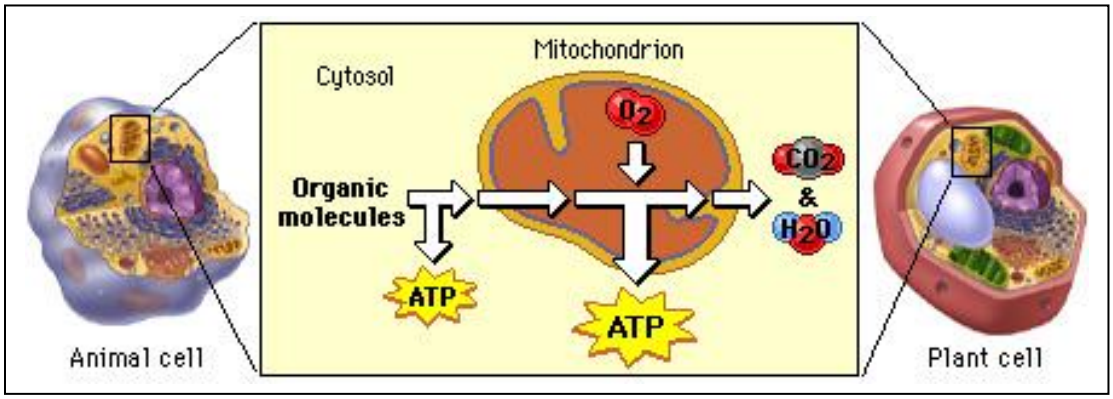
6. ATP: (cell usage examples)

a. Used by cell processes to maintain homeostasis of cell

b. Active transport to remove toxins

c. Movement to find food, run away from danger, grow, reproduce

d. Make proteins



K. <u>Cellular Respiration (How Cells Make ATP Energy)</u>

1. Occurs in <u>ALL</u> living things all the time, two types of cellular respiration

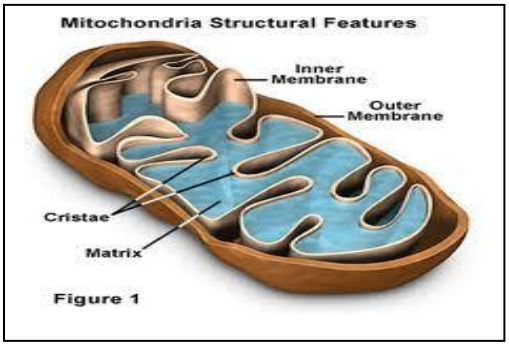
a. Aerobic respiration

b. Anaerobic respiration

2. **<u>Aerobic respiration</u>** occurs in mitochondria of cell (when oxygen is available)

a. inner folds of mitochondria: called **<u>cristae</u>**

b. more cristae = more surface area for respiration to occur

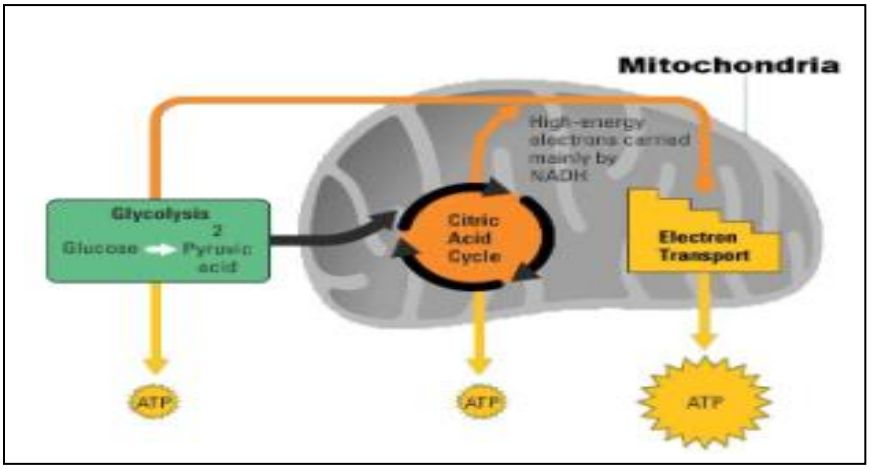


b. Three steps of aerobic respiration:

i. **Glycolysis –** Initial break down of glucose, without oxygen creates 2 ATP

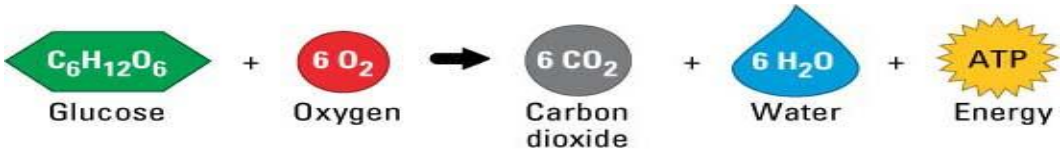
ii. **Citric acid cycle (Kreb's cycle) –** Takes output of glycolysis and releases electrons for electron transport chain to use

iii. **Electron transport chain (ETC)** – Final step in which the majority of the ATP is created, 32-36 ATP total at the end



3. Chemical equation for <u>aerobic respiration</u> :

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_20 + 32\text{-}36\ ATP$$



<reactants> → <products>

4. Factors affecting the rate of cellular respiration:

a. amount of glucose available

b. amount of oxygen available

5. Anaerobic Respiration

a. In plant cells and yeast cells the following occurs in the cytoplasm after glycolysis when no oxygen is available. Because ethanol is created in addition to the 2 ATP it is called alcoholic fermentation.

$$C_6H_{12}O_6 \rightarrow CO_2 + \text{ethanol} + 2\text{-}4\ ATP$$

glucose → carbon dioxide +ethanol + 2-4 ATP

b. In animal cells the following occurs in the cytoplasm after glycolysis when no oxygen is available. Because lactic acid is created in addition to the 2 ATP it is called lactic acid fermentation.

$$C_6H_{12}O_6 \rightarrow CO_2 + \text{lactic acid} + 2\text{-}4\ ATP$$

glucose → carbon dioxide + lactic acid + 2-4 ATP

c. in anaerobic respiration, there is no oxygen used AND less ATP is created

d. Comparison of Aerobic versus Anaerobic respiration:

Aerobic cellular respiration	Anaerobic cellular respiration (with fermentation)
Uses oxygen	Does not use oxygen
Makes 32 to 36 ATP	Makes 2 ATP
Take place in the mitochondria	Takes place in the cytoplasm
Produces carbon dioxide, water, & 32 – 36 ATP	Produces carbon dioxide & 2 ATP AND either ethanol (plant cell) or lactic acid (animal cell)