CORNELL NOTES
Directions: You must create a minimum of 5 questions in this column per page (average). Use these to study your notes and prepare for tests and quizzes. Notes will be stamped after each assigned sections (if completed) and turned in to your teacher at the end of the Unit for scoring.

UNIT 2: CELLS
Chapter 4: Cells and Energy

I. Chemical Energy and ATP (4.1)

A. The **chemical energy** used for most cell processes is carried by _____

1. All **carbon-based molecules** in _____ store chemical energy in their _____

a. _____ and _____ most important energy sources.

b. Energy does come from _____ indirectly

2. All cells use energy carried by _____

a. **ATP** (adenosine triphosphate) is molecule that _____ energy from breakdown of food

b. ATP carries energy cells can use

c. Used for building molecules, moving materials by active transport, etc.

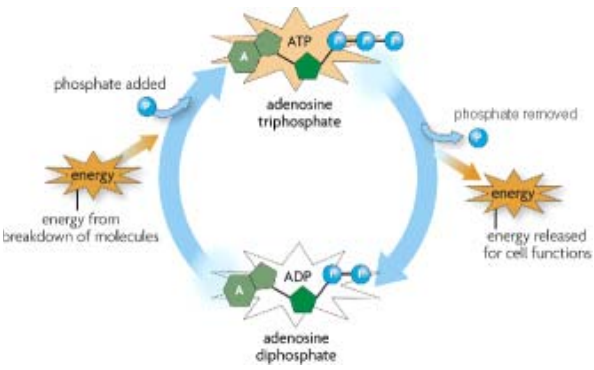
3. **Energy of ATP** released when _____ **group** is _____

a. Bond holding _____ **phosphate group** is **unstable** and very **easily broken**

b. When loses 3rd phosphate group, ATP becomes _____ **(adenosine diphosphate)**

1. **ADP** is a _____ energy molecule than ATP

2. Can be converted back into **ATP** with addition of _____ (adding phosphate group)



3. The breakdown of ATP to ADP and production of ATP from ADP can be represented by _____.

4. This requires complex group of _____ to help.

B. Organisms break down _____**-based molecules** to produce **ATP**

1. **Food** you eat _____ _____ contain **ATP**

a. Food must first be _____ (break down into smaller molecules)

b. Foods provide different amounts of _____ (**calories**)

2. **Number of ATP** molecules depends on _____ of **molecule** broken down (**Carbohydrate, Protein, lipid**)

+

a. _____ most commonly broken down to make ATP

b. Break down of _____ yields _____ **molecules** of ATP

3. _____ store about 80% of energy in your body

a. When broken down, yield the most ATP

b. A typical **triglyceride** yields about _____ **molecules of ATP**

4. _____ have about as much ATP as carbohydrates

a. Less likely to be broken down

b. **Amino acids** needed to **build new** _____

5. **Plants** also need ATP

a. **Plants** do not _____ to obtain energy

b. Use energy produced by _____ (make sugars from sunlight)

C. A few types of organisms do not need sunlight and photosynthesis as a source of energy

1. Some organisms use _____ to produce energy (sugars)

2. Used by organisms in _____ **vents** (deep ocean)

II. Overview of Photosynthesis (4.2)

A. **Photosynthetic** organisms are _____

1. **Producers** make their own source of _____ **energy**

2. _____ use **photosynthesis** and are producers

a. **photosynthesis** is process that **captures energy** from _____ to **make sugars** that store chemical energy

b. Uses _____ light made up of several _____ (wavelengths) of light.

1). Plants use molecule in **chloroplast** called _____

2). Two main types of chlorophyll

a. **Chlorophyll** a and **chlorophyll b**

b. Absorb mostly _____ and _____ wavelengths.

c. Plants appear _____ because reflect green light (not absorbed)

B. **Photosynthesis** in plants occurs in _____

1. Most of chloroplast are in _____ cells

2. _____ main parts of **chloroplasts** needed for **photosynthesis**

a. _____- stacks of coin-shaped, membrane-enclosed compartments called **thylakoids**.

b. **Membrane** in thylakoids contain _____

c. **Stroma** is the _____ that surrounds grana

C. **Photosynthesis** occurs in _____ **main stages**

1. **Light-dependent reactions** (capture _____ from _____)

a. Occurs **within** and **across** _____ of **thylakoids**

b. _____ and _____ are needed.

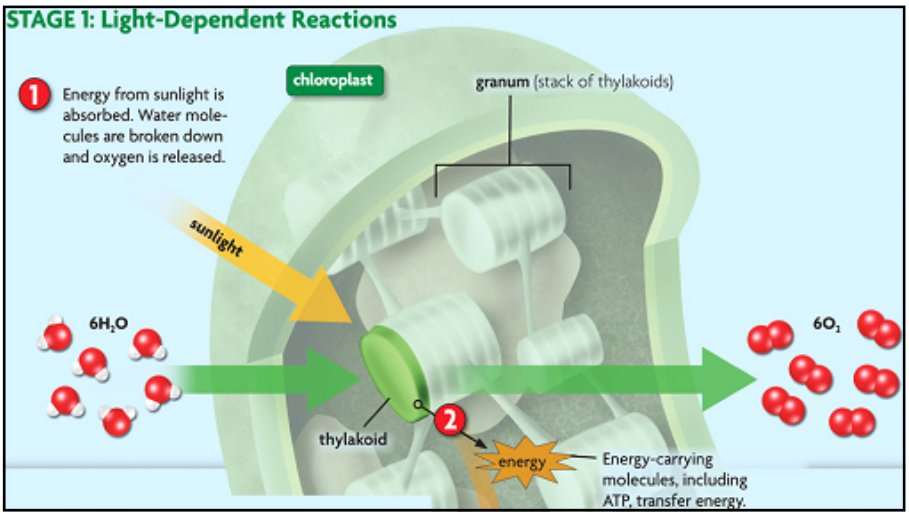
c. **Light dependent reactions**

1). **Chlorophyll** absorbs _____ from sunlight. (**photosystem**)

2). **Energy** transferred along thylakoid _____.

3). _____ molecules **broken down**.

4). _____ molecules **produced**



2. **Light independent reactions** (uses energy produced from light-dependent reactions)

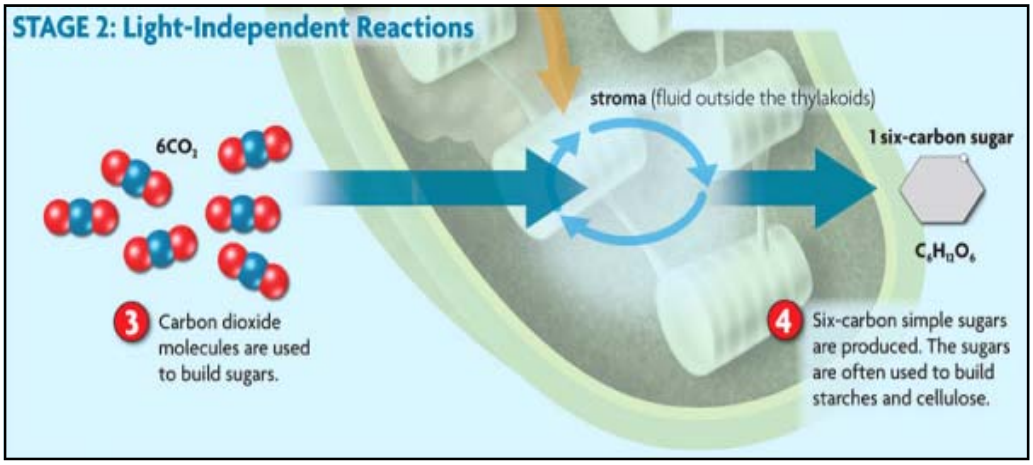
a. Occur in the _____ of chloroplasts

b. _____ **needed**

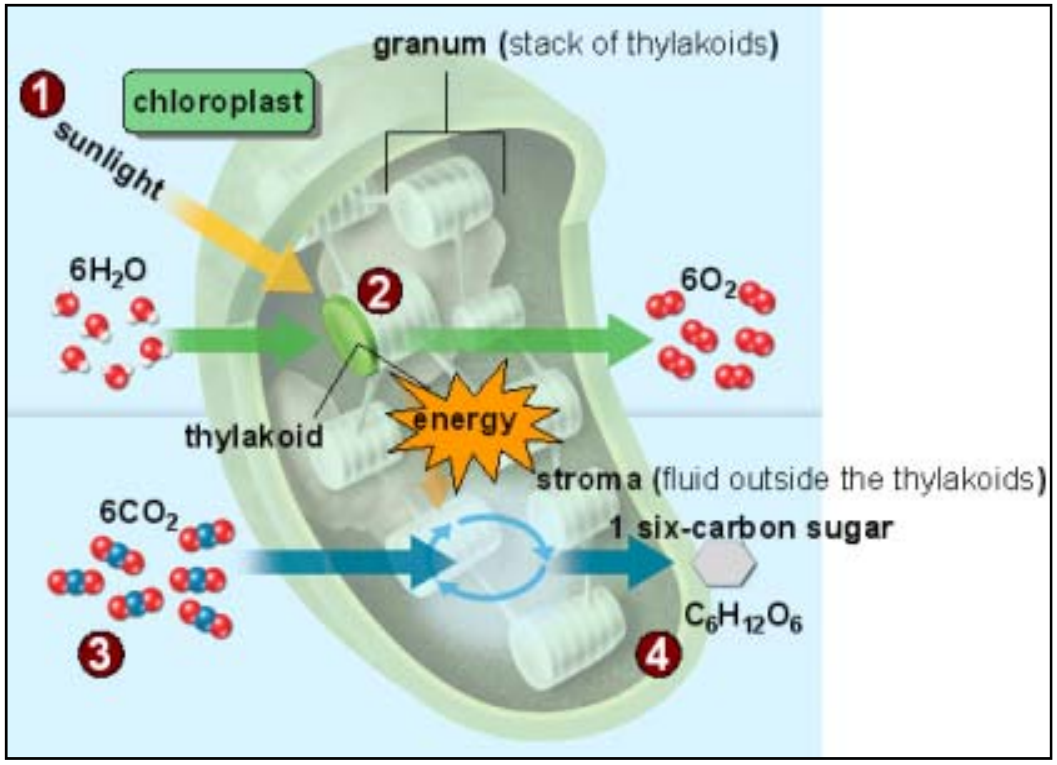
1). **CO_2 added** to cycle to build larger molecules (_____ **cycle**)

2). _____ from **light dependent** reactions is <u>used</u>

3). Molecule of **simple sugar** is <u>produced</u> (usually _____ **$C_6H_{12}O_6$**)



3. Equation for whole photosynthetic process



D. Functions of Photosynthesis

1. Plant produce _____ for **themselves** and **other** _____

2. **Animals** use _____ produced by photosynthesis in **cellular respiration** (released stored energy)

3. It **provides materials** for plant _____ and **development** (simple sugars bonded together to form carbohydrates like _____ and _____)

4. **Regulates Earth's** _____ (removes _____ _____ from Earth's atmosphere)

III. Overview of **Cellular Respiration** (4.4)

A. **Cellular respiration** makes _____ by breaking down _____ and other carbon-based molecules to make **ATP**

1. Cellular respiration is _____ (requires **oxygen**)

2. Takes place in _____ (cells "powerhouse")

B. Process starts with _____ (means "glucose breaking")

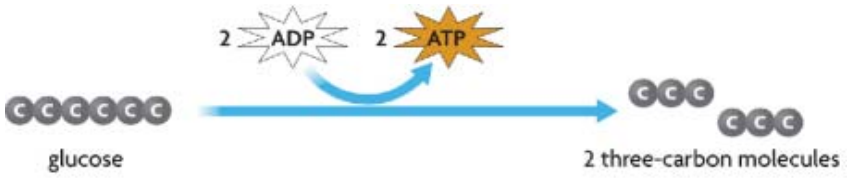
1. **6-carbon glucose** broken into two 3-carbon molecules of _____ _____

2. Produces ____ **molecules of ATP** (makes 4, but uses 2 ATP = **net of 2 ATP**)

3. _____ process (does not require **oxygen**)

4. Takes place in _____

5. Products of glycolysis used in respiration process.



C. Cellular **respiration** is like _____ image of **photosynthesis**

1. Chemical equation for cellular **respiration** is basically the _____ of that for **photosynthesis**

2. Structures in **chloroplast** and **mitochondria** are _____

D. Cellular Respiration takes place in _____ **main stages**

1. _____ **cycle**- takes place in interior space of _____.

a. ___**-carbon molecules** produced in **glycolysis** are broken down in a **cycle of chemical reactions**

b. _____ _____ is given off (**CO_2**)

c. _____ produced is transferred to 2nd stage (energy in the form of ATP and other "charged" molecules- **NADH** and **$FADH_2$**)

2. **Electron Transport Chain**-

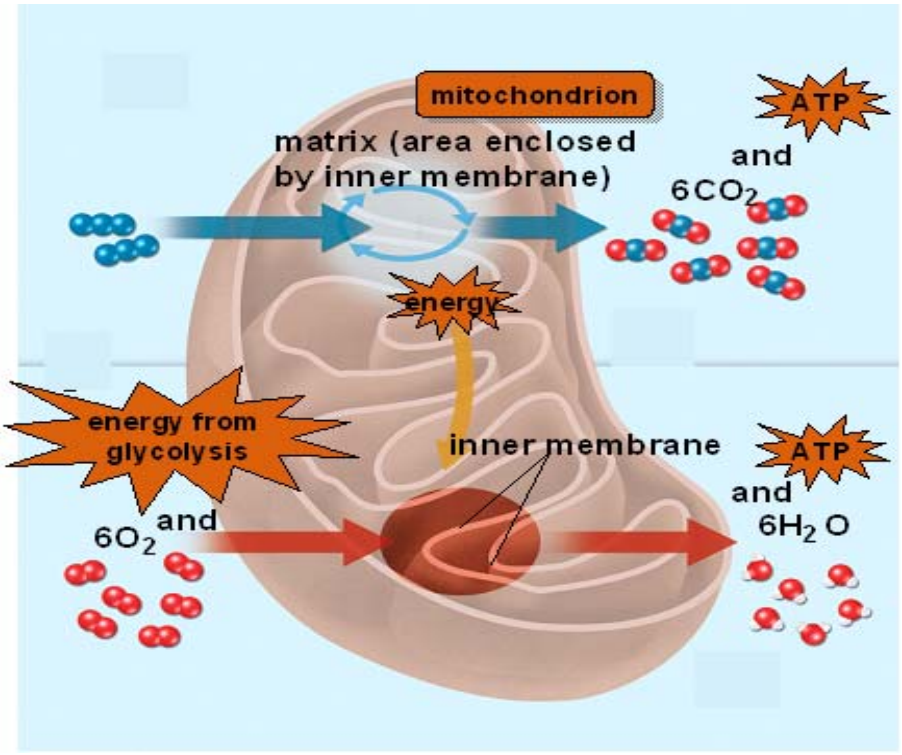
a. Takes place in _____ **membrane**

b. Energy transferred to _____ transport chain

c. _____ enters process and picks up **electrons** and **hydrogen** to <u>make</u> **H_2O (water)**

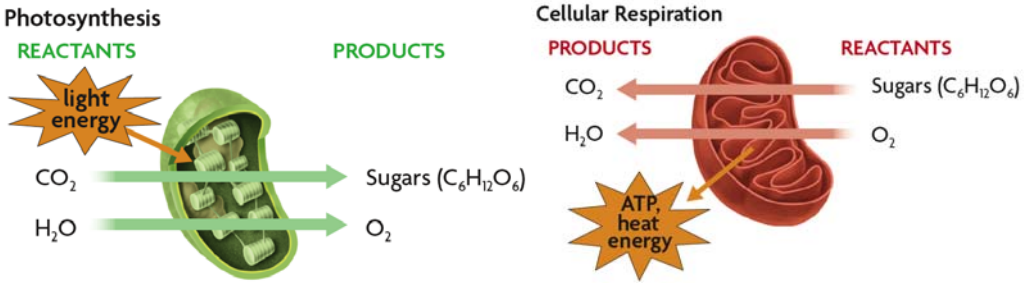
d. _____ **produced** (____ to ____ molecules) for a total of 36 to 38 including glycolysis

e. Many **enzymes** required for process



E. Overall equation of cellular respiration

F. Comparing Photosynthesis and Cellular Respiration (reactants of photosynthesis are same as products of cellular respiration)



IV. **Fermentation** (4.6)

A. **Fermentation** allows _____ to _____

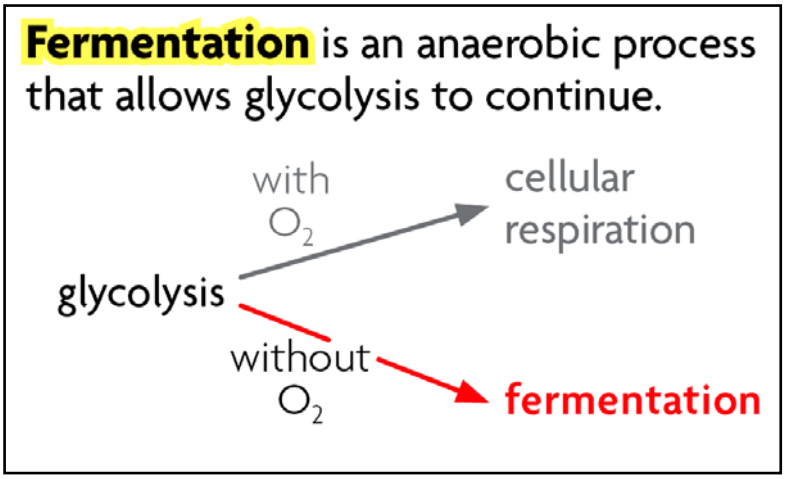
1. Fermentation allows glycolysis to continue making **ATP** when **oxygen is** _____

2. **Fermentation** is an _____ process

a. Occurs when oxygen not available for cellular respiration

b. Does <u>not produce</u> _____

3. **NAD^+** is <u>recycled</u> to _____



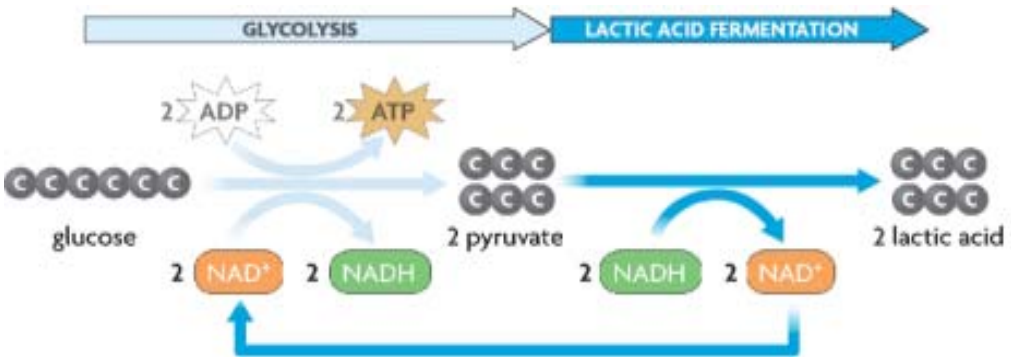
B. **Lactic Acid fermentation**- occurs in _____ **cells**

1. **Glycolysis** splits _____ into two **pyruvate** molecules

2. **Pyruvate** and _____ enter fermentation

3. **Energy** <u>from</u> **NADH** <u>converts</u> _____ into **lactic acid**

4. **NADH** is <u>changed back into</u> _____



C. **Alcoholic fermentation**- similar to lactic acid fermentation

1. Products of alcoholic fermentation include

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_____, _____, _____

2. **Glycolysis** splits _____ and products enter fermentation

3. **Energy** from **NADH** is used to spit **pyruvate** into an

_____ and _____ _____

4. _____ is changed back into **NAD^+**

5. **NAD^+** is recycled to _____