Name: _____ Date: Copy Class Period: _____

# Photosynthesis & Cellular Respiration

*Making food for an organism and using that food for energy!*

**Photosynthesis & Cellular Respiration PowerPoint Notes**

(These are posted on the website as well!)

1. Directly or indirectly, almost all of the ENERGY in living systems needed for metabolism comes from the SUN.

2. Define **energy**: THE ABILITY TO DO WORK

3. Compare and contrast **autotrophs** and **heterotrophs** (circle the correct answer)

| | Compare | Contrast |
|---|---|---|
| Heterotrophs | Energy involved? (Yes) or No<br>Living Thing? (Yes) or No | ~~Energy? needed or released~~<br>Energy source?: sun or other living thing |
| Autotrophs | Energy involved? (Yes) or No<br>Living Thing? (Yes) or No | ~~Energy? needed or released~~<br>Energy source? sun or other living thing |

Review and answer *questions about metabolism from video clip:* (**Metabolism: What is Metabolism?**) **While the video covers a lot of material, you will only be responsible for the material below.**

https://www.youtube.com/watch?v=5qjgEKqVkSo

1. Metabolism involves the CREATION of complex MOLECULES from SIMPLE molecules and is also called ANABOLISM. Metabolism is also the BREAKDOWN of complex MOLECULES into SIMPLER molecules and is also called CATABOLISM.

2. **Not in video:** Therefore, metabolism involves building up (ANABOLISM) and breaking down (CATABOLISM) of molecules. It think of this as building with Legos then taking them apart.

3. All living things get their building blocks from FOOD whether they make it themselves (autotrophs) or bring it in from the outside (heterotrophs). When catabolism breaks down molecules into smaller units and releases ENERGY.

4. ANABOLISM requires energy to build molecules. The types of molecules built during anabolism includes NUCLEIC ACIDS, LIPIDS, CARBOHYDRATES, and PROTEINS.

5. The four organic building blocks come from PRECURSORS. The precursors come from the breakdown (anabolism) of FOOD and CELL COMPONENTS. Precursors are _____ that when assembled become one of the major building blocks of a CELL. We often call these "subunits" or "repeating molecules".

6. Match the four precursors to the building block they make:

| Reactants | **Nucleotides** | **Amino Acids** | **Monosaccharides** | **Fatty Acids** |
|---|---|---|---|---|
| Products | Nucleic Acids | PROTEIN | CARBOHYDRATES | LIPIDS |

7. **Anabolism** is the set of metabolic processes that require ENERGY (that comes from food) to build large complex MOLECULES.

8. Anabolism has 3 stages:

| | | |
|---|---|---|
| 1. PRECURSORS are produced. "SMALL MOLECULES" | 2. Precursors (building blocks) are ACTIVATED using energy. (ATP) | 3. The activated precursors begin to form the 4 biomolecules. Proteins, Carbohydrates, Lipids, Nucleic Acids |

9. Autotrophs (like PLANTS) can MAKE complex molecules like carbohydrates and proteins from simple molecules like $CO_2$ and $H_2O$. Heterotrophs (like YOU), NEED complex molecules like carbohydrates and proteins to make complex molecules. This is why we eat FOOD!

**Skip the "Trophs Flow Sheet" section of video. Resume watching at 5:16.**

10. **Catabolism** is the BREAKDOWN of complex molecule that release ENERGY.

11. Fill in the chart below to list the molecules the complex molecules break into:

| Reactants | Carbohydrates (Polysaccharides) | Lipids | Nucleic Acids | Proteins |
|---|---|---|---|---|
| Products | MONOSACCHARIDE | FATTY ACID | NUCLEOTIDES | AMINO ACIDS |

12. When catabolism takes place, ENERGY is released in the form of ATP (adenosine triphosphate).

**Note:** All of this ENERGY needed for anabolism and used in catabolism is called **ATP**. This is the "battery" that a cell runs on! When large molecules are broken down and energy is released, there are sometimes "extra" atoms/molecules left over. This is waste and is commonly removed from the organism.

13. Some of the waste products produced during catabolism include acetic acid, ammonia, LACTIC ACID, UREA, and carbon dioxide. So you can see that anabolism and catabolism go on in a big circle in living organisms all the time!

14.

| Anabolism | vs. | Catabolism |
|---|---|---|
| Create new STRUCTURES & ENZYMES | | Destroy old STRUCTURES for RECYCLING |
| Store unused NUTRIENTS for later use. | | Breakdown FOOD. |

Two Types of Metabolism we will be learning about:

1. PHOTOSYNTHESIS (ANABOLISM) – MAKING GLUCOSE USING ENERGY
2. CELLULAR RESPIRATION (CATABOLISM) – BREAKING DOWN GLUCOSE RELEASING ENERGY

## Photosynthesis

Word Equation

WATER + CARBON DIOXIDE + LIGHT ENERGY → GLUCOSE + OXYGEN
(REACTANTS) (PRODUCTS)

Chemical Equation

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

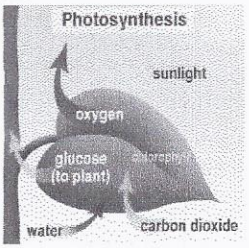
Goal of Process: MAKE GLUCOSE (FOOD) FOR PLANT CELLS

Where in the cell does this process take place? CHLOROPLAST

What attracts the sunlight to the chloroplast? CHLOROPHYLL

Anabolic (building up a biomolecule (GLUCOSE (CARB)) requiring an input of energy (LIGHT)) or
Catabolic (breaking down a biomolecule and releasing energy)?
Photosynthesis is ANABOLIC.

**We are going to stop here for a quick video (1:41 min) then an open note quiz on Photosynthesis!**




What living organisms do Photosynthesis?
AUTOTROPHS LIKE PLANTS AND SOME BACTERIA

# Cellular Respiration

Word Equation

GLUCOSE + OXYGEN → CARBON DIOXIDE + WATER + ATP

ENERGY FOR ALL TYPES OF CELLS!

Chemical Equation

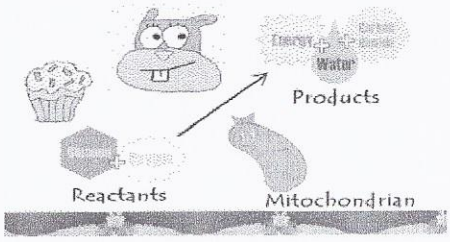
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$

Goal of Process: TURN GLUCOSE (FOOD) INTO CELLULAR ENERGY (ATP).

Where in the cell does this process take place? MITOCHONDRIA

Anabolic (building up a biomolecule requiring an input of energy) or
Catabolic (breaking down a biomolecule and releasing energy)? GLUCOSE (CARB) ATP
Cellular Respiration is CATABOLIC.

**Cellular Respiration**



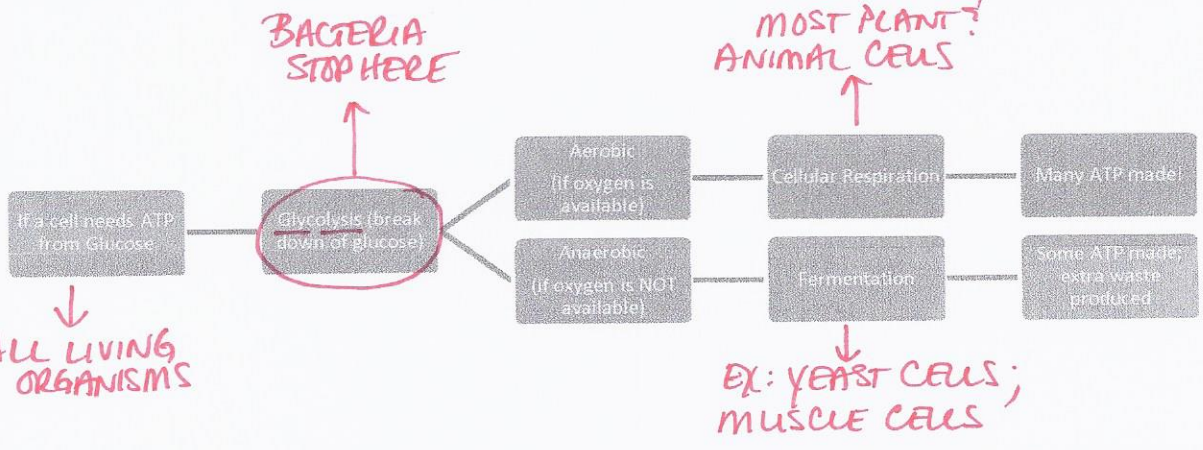

AUTOTROPH & HETEROTROPH

PLANTS // ANIMALS // FUNGI // PROTISTS

Which living organisms do Cellular Respiration? ALL EUKARYOTIC ORGANISMS

**We are going to stop here for a quick video (1:27 min) and an open note quiz on Cellular Respiration.**

Some cells can make ATP without oxygen. Examples: muscle cells and yeast cells. But...they pay the price!



**Fermentation:** THE PROCESS IN WHICH CELLULAR ENERGY (ATP) IS MADE WITHOUT OXYGEN.

Another word for fermentation is ANAEROBIC which means without OXYGEN. If your cells needed to make energy in the absence of oxygen...it would still make that energy (ATP), but you would pay a price. Some form of waste would be produced.

Examples of Fermentation

Chemical Equation for Fermentation in Muscle Cells (Lactic Acid Fermentation)

$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 + ATP +$ LACTIC ACID

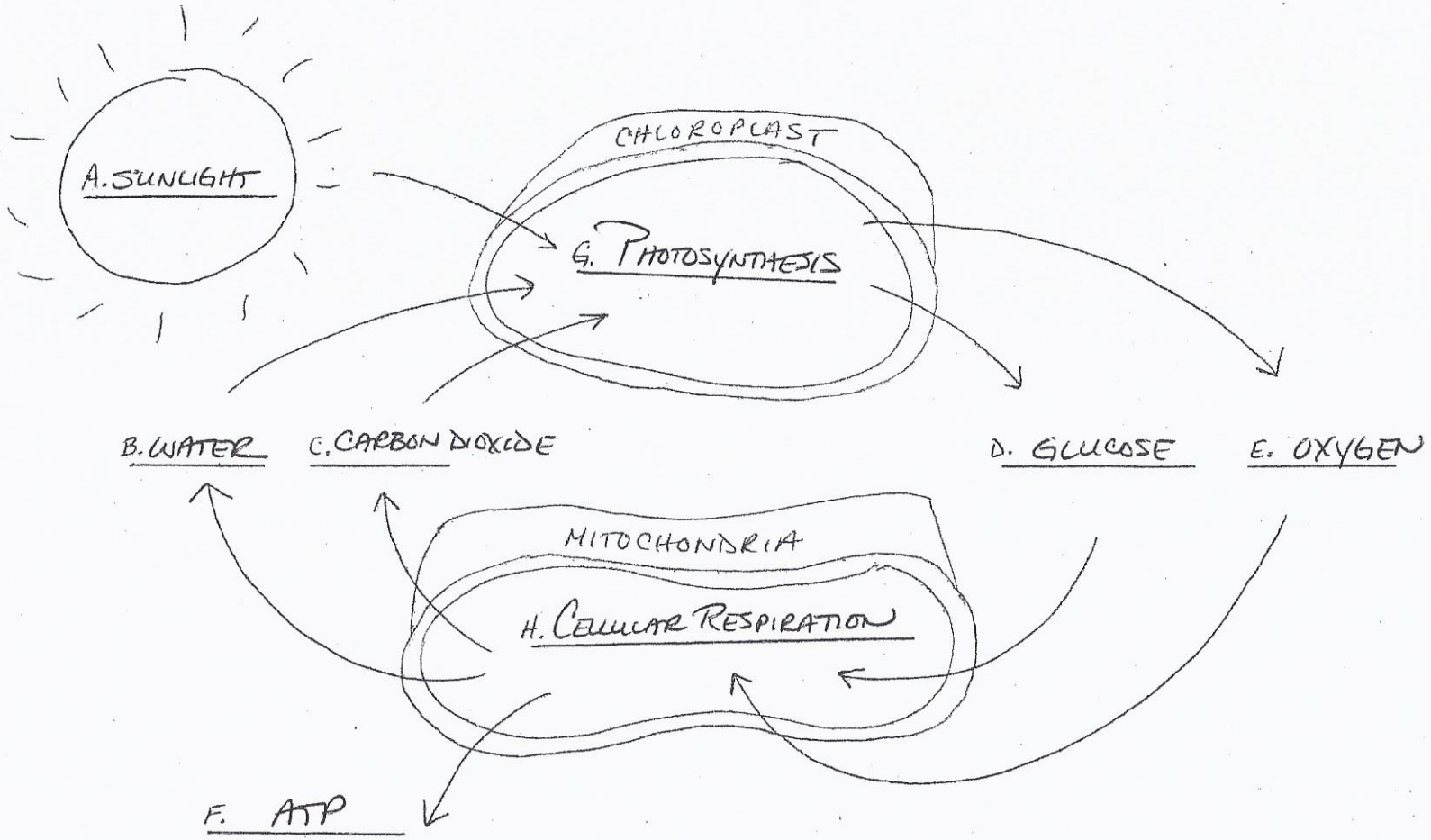
→ USED FOR MAKING FOOD/DRINKS.

Chemical Equation for Fermentation in Yeast Cells (Alcoholic Fermentation)

$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 + ATP +$ ALCOHOL

**Photosynthesis & Cellular Respiration Practice**

| Process | What goes in? REACTANTS | What comes out? PRODUCTS | Where does this happen? |
|---|---|---|---|
| Photosynthesis | Words: WATER, CARBON DIOXIDE, LIGHT → Chemical Formulas: $6H_2O$, $6CO_2$, LIGHT → | Words: GLUCOSE, OXYGEN Chemical Formulas: $C_6H_{12}O_6$, $6O_2$ | AUTOTROPHS SELF FEEDERS (PLANTS) CHLOROPLAST CHLOROPHYLL |
| Cellular Respiration | Words: GLUCOSE, OXYGEN → Chemical Formulas: $C_6H_{12}O_6$, $6O_2$ → | Words: WATER, CARBON DIOXIDE, ATP Chemical Formulas: $6H_2O$, $6O_2$, ATP | AUTOTROPHS AND HETEROTROPHS (PLANTS & ANIMALS) MITOCHONDRIA |
| Fermentation | Words: GLUCOSE, ~~OXYGEN~~ → Chemical Formulas: $C_6H_{12}O_6$, ~~$6O_2$~~ → | Words: WATER, CARBON DIOXIDE, ATP Chemical Formulas: $6H_2O$ $6CO_2$, ATP | SOME CELLS EX: YEAST CELLS MUSCLE CELLS |




A. Where plants get their energy for their "food" making process.
B. Taken in by plant through its roots. Molecule looks like Mickey Mouse.
C. Taken in by plant through leaves. Gas that animals relase.
D. "Food" that is made by plants.
E. Released by plants. Gas that animals and plants need.
F. Energy for the cell. Batteries that run the cell.
G. Process in which plants make their own "food".
H. Process in which plants and animals use "food" and turn it into cellular energy.