**Cellular Respiration Notes**

Name:

**Overview of Cellular Respiration**

* Overall Definition: A chemical process that uses \_\_\_\_\_\_\_\_\_\_\_\_\_\_to convert the chemical energy stored in organic molecules (\_\_\_\_\_\_\_\_\_\_\_\_\_\_) into another form of energy –\_\_\_\_\_\_\_\_\_\_\_\_. \_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_are produced in this process.



* **Occurs in heterotrophs and autotrophs** (plants, animals, bacteria, fungus, and protists)
* Is a **metabolic pathway** (a series of more than two dozen chemical reactions that are accelerated by special proteins called ENZYMES).
* Begins in the **cytosol** (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_) and ends in the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* **Has 3 main stages**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(Citric acid cycle), and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and ATP synthase
* The end product of cellular respiration, \_\_\_\_\_\_\_\_\_, is used by cells as their\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Cellular Respiration**: Glucose + 6 Oxygen 6 Carbon Dioxide + 6 Water + Energy (36 ATP)

**Photosynthesis**: Energy (Sunlight) + 6 Carbon Dioxide + 6 Water Glucose + 6 Oxygen

How does the equation for photosynthesis compare to the equation for cellular respiration?

**ATP A Review:**

* ATP provides energy for cellular work
	+ Energy is released when \_\_\_\_\_\_\_\_is converted to \_\_\_\_\_\_
	+ Energy from the organic molecules in food are used to add a phosphate group to \_\_\_\_\_\_\_\_\_so that it can be converted into \_\_\_\_\_\_\_\_\_\_again.
	+ ATP is used for chemical work (ex. building proteins from amino acids), mechanical work (ex. contraction of a muscle), and transport work (ex. pumping solutes across a cell membrane
* The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_are the major sites of cellular respiration
* The controlled breakdown of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into CO2 and H2O.
* Requires oxygen
* Energy is captured in the form of \_\_\_\_\_\_
* The balanced chemical equation for the reaction of cellular respiration is:
* **C6H12O6 + \_\_O2** → **\_\_CO2 + \_\_H2O + 36–38 molecules of ATP**

**Cellular respiration takes place in three different stages**

* + **Stage 1** is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ **Stage 2** is **The Citric Acid Cycle** (also called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
	+ **Stage 3** is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**and ATP synthase**

**Glycolysis**

* Takes place in the cytoplasm outside the mitochondria
* Literally means “splitting of sugar” (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)
* Two ATP’s are used to split one glucose molecule (a 6 carbon sugar) into 2 molecules of pyruvic acid/pyruvate (with 3 carbons)

 Does not require \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**END PRODUCTS OF GLYCOLYSIS:**

* + **\_\_\_\_\_\_\_** molecules of ATP (a net gain of 2 ATP molecules – 2 are used to start the reaction)
	+ 2 NADH molecules (each NAD+ carries 2 electrons and 1 H ion from each 3 carbon sugar 🡪 NADH)
	+ 2 molecules of pyruvate (used in the Krebs cycle)

**The Krebs Cycle**

* Occurs in the matrix of the mitochondria
* Requires pyruvic acid from glycolysis
* Requires \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

END PRODUCTS OF the Krebs Cycle:

* + 2 ATP molecules
	+ 4 CO2 molecules
	+ 6 \_\_\_\_\_\_\_\_\_molecules and 2 \_\_\_\_\_\_\_\_molecules

**The Electron Transport Chain and ATP Synthase**

* Occurs in the inner (cristae) membrane of the mitochondria
* NADH and FADH2 carry high-energy electrons to the electron transport chain
* As electrons “fall” down the chain toward\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a small amount of energy is released
* This energy is used to generate \_\_\_\_\_\_\_ production (from ADP + P) using a special protein structure called an ATP synthase.
* **This process generates up to \_\_\_\_\_\_ ATP’s!**



**Anaerobic Respiration**

* Does ­­\_\_\_\_\_\_\_\_\_\_\_\_\_require \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Occurs in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Much less efficient than aerobic (cellular) respiration because only \_\_\_\_\_\_\_\_\_\_molecules of ATP are formed (instead of 38).
* Two main types of Anaerobic Respiration:
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Fermentation
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Fermentation

**Lactic Acid Fermentation**

* Used by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cells when oxygen has run out
* Pyruvate (from glycolysis) is converted to lactic acid.
* Occurs in muscle cells, as well as in some bacteria and fungi.
* The liver converts lactic acid back to pyruvate once oxygen is available.

**Alcoholic Fermentation**

* Used by many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(ex. yeast)
* Pyruvate is converted to \_\_\_\_\_\_\_ and ethyl alcohol