**Chapter 9 – Cellular Respiration**

Section 1 – Chemical Pathways

* Chemical Energy and Food
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ serves as a source of raw materials for the cells in the body and as a source of energy.
	+ One gram of the sugar glucose (C6H12O6), when burned in the presence of oxygen, releases 3811 calories of heat energy.
	+ A **\_\_\_\_\_\_\_\_\_\_\_\_** is the amount of energy needed to raise the temperature of 1 gram of water 1 degree Celsius.
	+ Cells don't “burn” glucose. Instead, they gradually release the energy from glucose and other food compounds.
	+ This process begins with a pathway called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
		- Glycolysis releases a small amount of energy.
	+ If oxygen is present, glycolysis is followed by the Krebs cycle and the electron transport chain.
	+ Glycolysis, the Krebs cycle, and the electron transport chain make up a process called **\_\_\_\_\_\_\_\_\_\_\_\_\_ respiration**.
* Overview of Cellular Respiration
	+ **Cellular respiration is the process that releases \_\_\_\_\_\_\_\_\_\_\_\_\_ by breaking down glucose and other food molecules in the presence of oxygen.**
		- The equation for cellular respiration is:
			* 6O2 + C6H12O6 → 6CO2 + 6H2O + Energy
			* oxygen + glucose → carbon dioxide + water + Energy
			* This equation is the exact opposite of \_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Each of the three stages of cellular respiration captures some of the chemical energy available in food molecules and uses it to produce \_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Glycolysis takes place in the \_\_\_\_\_\_\_\_\_\_\_\_\_. The Krebs cycle and electron transport take place in the mitochondria.



Chemical Pathways (Part 2)

* Glycolosis
	+ **Glycolysis is the process in which one molecule of glucose is broken in \_\_\_\_\_\_\_\_\_\_\_\_\_**, producing two molecules of pyruvic acid, a 3-carbon compound.
	+ The Advantages of Glycolysis
		- The process of glycolysis is so fast that cells can produce \_\_\_\_\_\_\_\_\_\_\_\_\_ of ATP molecules in a few milliseconds.
		- Glycolysis does not require \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
		- Therefore, glycolysis is an anaerobic process.
* Fermentation
	+ When oxygen is not present, glycolysis is followed by a different pathway. The combined process of this pathway and glycolysis is called fermentation.
	+ **Fermentation** \_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy from food molecules by producing ATP in the absence of oxygen.
	+ **The two main types of fermentation are lactic acid fermentation and alcoholic fermentation.**
		- Alcoholic Fermentation
			* Yeasts and a few other microorganisms use alcoholic fermentation, forming ethyl alcohol and carbon dioxide as wastes.
		- Lactic \_\_\_\_\_\_\_\_\_\_\_\_ Fermentation
			* Lactic acid fermentation converts glucose into lactic acid.
			* This is the reason why muscles \_\_\_\_\_\_\_\_\_\_\_\_ during physical activity.

Section 2 - The Krebs Cycle and Electron Transport

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is required for the final steps of cellular respiration.
* Because the pathways of cellular respiration require oxygen, they are **\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
* The Krebs Cycle
	+ In the presence of oxygen, pyruvic acid produced in glycolysis passes to the \_\_\_\_\_\_\_\_\_\_\_\_\_ stage of cellular respiration, the **Krebs cycle**.
	+ During the Krebs cycle, pyruvic acid (from glycolysis) is broken down into \_\_\_\_\_\_\_\_\_\_\_\_\_\_ dioxide in a series of energy-extracting reactions.
	+ As a result, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is produced.
	+ Also, high energy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are produced to aid take part in the electron transport chain.
* Electron Transport Chain
	+ The electron transport chain uses the high-energy electrons from the Krebs cycle to convert \_\_\_\_\_\_\_\_\_\_\_\_ into ATP.
	+ On average, each pair of high-energy electrons that moves down the electron transport chain provides enough energy to produce three molecules of ATP from ADP.
* The Totals
	+ Glycolysis produces just 2 ATP molecules per molecule of glucose.
	+ The complete breakdown of glucose through cellular respiration, including glycolysis, results in the production of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules of ATP.
* Comparing Photosynthesis and Cellular Respiration
	+ The energy flows in photosynthesis and cellular respiration take place in \_\_\_\_\_\_\_\_\_\_\_\_\_ directions.
* On a global level, photosynthesis and cellular respiration are also opposites.
	+ Photosynthesis \_\_\_\_\_\_\_\_\_\_\_\_\_\_ carbon dioxide from the atmosphere and cellular respiration puts it back.
	+ Photosynthesis \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ oxygen into the atmosphere and cellular respiration uses that oxygen to release energy from food.