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**Essential Knowledge**

**2.a.1.** All living systems require constant input of free energy. Without free energy organisms would be unable to live and essentially, the world would not function. The **Krebs Cycle** , which is a part of cellular respiration, requires free energy in order to produce ATP. Without the ATP produced by the Kreb Cycle the cell would not be able to function. **Glycolysis** needs two ATP in order to perform. Glycolysis is a process in the cytoplasm of a cell where glucose is broken down and ATP is formed without the loss of oxygen. The **Calvin Cycle** is a part of photosynthesis and needs ATP as well in order to perform the making of glucose. The 3 ATP needed for the Calvin Cycle indirectly comes from free energy. **Fermentation** is a catabolic process that makes a limited amount of ATP from glucose without an electron transport chain and that produces a characteristic end product, such as ethyl alcohol or lactic acid. Fermentation needs ATP in order to produce an end product, exemplifying once again that all systems require the constant input of free energy.

**4.b.1**. Interactions between molecules affect their structure and function. Enzymes are substrate specific meaning they have to fit their activation site perfectly in order to carry on their “jobs”. Elements such as a high or low pH could denature an enzyme, making the substrate unable to fit into its activation site.

**2.a.2.** Organisms capture and store free energy for use in biological processes. **NADP+** is used within Photosynthesis. During photosynthesis it is reduced into NADPH which then carries hydrogen to the Calvin Cycle to make glucose. **Oxygen** is used in the electron transport chain. It “carries” electrons through the electron transport chain which results in the making of ATP. Oxygen is also a product of cellular respiration. It accepts hydrogen and forms water, which then allows the energy to be stored in the cell. After this happens, cellular respiration is complete.