**Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ # \_\_\_\_\_\_ Biology Exploration Guide**: Cell Metabolism #1

 Introduction to Metabolism

**Key Concepts**: 

* An organism’s metabolism transforms matter and energy
* The free-energy change of a reaction tells us whether or not the reaction occurs spontaneously
* ATP powers cellular work by coupling exergonic reactions to endergonic reactions

**Read:**

* Chapter 8.1-8.3

**Key Terms**: Here is a list of key terms and concepts you will hear about and see during the chapter readings. Get to know them!

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| --- | --- | --- | --- |
| *Catabolic pathways* | *Entropy* |  |  |
| *Anabolic pathways* | *Free energy* |  |  |
| *Kinetic energy* | *Endergonic reaction* |  |  |
| *Potential energy* | *Exergonic reaction* |  |  |
| *Thermodynamics*  | *Energy coupling* |  |  |
| *1st law of thermodynamics* | *ATP – adenosine triphosphate*  |  |  |
| *2nd law of thermodynamics* | *Phosphorylation*  |  |  |

**Exploration Questions**

1. Explain the role of ***catabolic*** and ***anabolic*** pathways in cellular metabolism.
2. State the ***first law of thermodynamics*** in your own words and explain how living systems comply with this law.  Provide one real-life example to support your explanation.
3. State the ***second law of thermodynamics*** in your own words and explain how living systems comply with this law.  Provide one real-life example to support your explanation.
4. Describe the forms of energy found in an apple as it grows on a tree, falls, and then is digested by someone who eats it.
5. Define ***free energy***.
6. Distinguish between ***exergonic*** and ***endergonic*** reactions in terms of free energy change.
7. Is a living system ever in ***equilibrium*** with its surroundings?  Explain why or why not, and when equilibrium occurs (if ever).
8. Explain the energetic advantage of ***coupling*** exergonic reactions to endergonic reactions.  Which reaction must be greater in terms of energetic magnitude?
9. Organisms are endergonic systems.  What are the exergonic reactions that provide living systems with energy (give 2 examples).
10. Cellular respiration uses glucose and oxygen, which have high levels of free energy, and releases CO2 and water, which have low levels of free energy. Is cellular respiration spontaneous or not? Is it exergonic or endergonic? What happens to the energy released from glucose?
11. Describe the structure of ***ATP*** and identify the major class of macromolecules to which ATP belongs.
12. Draw a sketch of the ATP-ADP cycle.  Explain how ATP performs cellular work using ***energy coupling***. In other words, describe how ATP and ADP are used in both the storing (endergonic) and releasing (exergonic) of energy