**Topic Review Guide**: Energy Exchanges

**To Think About**: How do living things use energy and matter to survive in an ecosystem? In what ways do communities interact within their environments that result in the movement of matter and energy?

**Watch:**

**First:** [Mr. Andersen’s “Life Requires Free Energy” video](http://viewpure.com/JBmykor-2kU&list=PLFCE4D99C4124A27A&index=16)

**Then**: [Mr. Andersen’s “Photosynthesis and Respiration” video](http://viewpure.com/0IJMRsTcwcg&list=PLFCE4D99C4124A27A&index=17)

**Next:** [Mr. Andersen’s “Cellular Respiration” video](http://viewpure.com/Gh2P5CmCC0M&list=PL7A750281106CD067&index=40)

**Last:** [Mr. Andersen’s “Photosynthesis” video](http://viewpure.com/g78utcLQrJ4&list=PL7A750281106CD067&index=39)

**Read:** Chapter 6.1, Hillis et al. Principles of Life, 1st edition (2012), pages 100-106

**Then**: Chapter 6.2-6.4, pages 106-113

**Last**: Chapter 6.5-6.6, pages 113-120

**Supplementary Resources**: Click the links below for more information to help you learn more about this lesson.

* Hillis et al.: [Electron Transport and ATP Synthesis animated tutorial](http://bcs.whfreeman.com/hillis1e/#667501__674135__)
* Hillis et al.: [Glycolysis and Fermentation tutorial](http://bcs.whfreeman.com/hillis1e/#667501__708804__)
* Hillis et al.: [Photophosphorylation](http://bcs.whfreeman.com/hillis1e/#667501__674136__)
* Sumanas, Inc.: [Cellular Respiration Animation](http://www.sumanasinc.com/webcontent/animations/content/cellularrespiration.html)
* Virtual Cell Animation: [Glycolysis, Step by Step](http://vcell.ndsu.nodak.edu/animations/glycolysis_overview/first.htm)
* Virtual Cell Animation: [Photosynthesis (Light Reactions)](http://vcell.ndsu.nodak.edu/animations/photosynthesis/index.htm)
* Wiley’s Interactive Concepts in Biochemistry: [Photosynthesis](http://www.wiley.com/college/boyer/0470003790/animations/photosynthesis/photosynthesis.htm)
* University of Vermont: [Photosynthesis Animation](http://dendro.cnre.vt.edu/forestbiology/photosynthesis.swf)
* PHSchool.com: [Cellular Respiration Animation](http://www.phschool.com/atschool/phbio/active_art/cellular_respiration/index.html)

**Listen and Look**: Here is a list of key terms and concepts you will hear about and see during these podcasts and chapter readings. Get to know them! Be able to connect them to one another using a concept map.

**KEY TERMS**

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| Free energy | ATP | Exergonic reaction | Endergonic reaction |
| Metabolism | Glycolysis | Pyruvate | Krebs cycle |
| Oxidation | Reduction | Phosphorylation | Oxidative phosphorylation |
| NAD/NADH | Fermentation | 1st law of thermodynamics | 2nd law of thermodynamics |
| Mitochondrion | Matrix | Electron transport chain | Stroma |
| Photosynthesis | NADP/NADPH | Thylakoid | Light-dependent reaction |
| Photon (of light) |  | Photophosphorylation | Light-independent reaction |

**Recall and Review:** Use the lecture in the video and your textbook reading to help you answer these questions in your BILL.

1. **Draw** a sketch of the ATP-ADP cycle.  **Explain** how this represents a cycle of endergonic and exergonic reactions.
2. **Explain** why living things do not violate the 1st and 2nd laws of thermodynamics in carrying on metabolic processes.
3. The processes of oxidation and reduction are critical to the success of metabolic processes such as cellular respiration and photosynthesis. **Explain** where oxidation and reduction occur during the three major stages of cellular respiration:
   1. Glycolysis
   2. Krebs Cycle
   3. Oxidative phosphorylation
4. The process of glycolysis does not require oxygen in order to occur.  **Explain** what this tells us about the evolutionary history of this metabolic process.
5. In the absence of oxygen, fermentation occurs.  **Explain** the primary purpose of this process.
6. **Identify** the source of the electrons that travel down the electron transport chain. **Explain** why oxygen is the final electron acceptor in aerobic cellular respiration.
7. **Create** a graphic organizer that illustrates the reactants and products for each of the major stages of cellular respiration:
   1. Glycolysis
   2. Krebs Cycle
   3. Oxidative phosphorylation
8. **Compare and contrast** chemiosmosis that takes place in the mitochondria to produce ATP to the osmosis of water that can occur in a cell.
9. Carbohydrates are the primary energy source for many cells, but proteins and lipids can also be used.  **Describe** where these alternative energy sources enter the process of cell respiration.
10. **Explain** why photosynthesis considered to be an anabolic, endergonic process.
11. **Explain** the role of chlorophyll and other pigments in the photosynthetic process.
12. **Identify** the source of electrons for the photosynthetic process.
13. In plants, the light-dependent reactions occur on thylakoid membranes inside the chloroplast.  **Describe** where these reactions occur in photosynthetic prokaryotes.
14. **Compare and contrast** the electron transport chains of photosynthesis to those in cellular respiration.
15. **Create** a t-chart that **describes** the similarities and differences between the Calvin cycle and the Krebs cycle.

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| Learn More: For more information about energy exchanges and how they make the world go round, check out the links below:   * NOVA—[Illuminating Photosynthesis: Help the process of photosynthesis along in this game](http://www.pbs.org/wgbh/nova/nature/photosynthesis.html) * John Kyrk: [Glycolysis Animation](http://www.johnkyrk.com/glycolysis.html) * John Kyrk: [Oxidative Phosphorylation Animation](http://www.johnkyrk.com/mitochondrion.html) * John Kyrk: [Krebs Cycle Animation](http://www.johnkyrk.com/krebs.html) |