**Part 1:  Introduction and Anaerobic Respiration**

**Questions to answer:**

1. What is the relationship between photosynthesis and aerobic cellular respiration?
2. In cellular respiration, what is oxidized and what is reduced?
3. What is the role of electron carrier molecules in energy processing systems?  Why are they necessary?
4. Is glucose the only molecule that can be catabolized during cellular respiration?  Why do we use glucose as the model?
5. Why do hydrogen atoms accompany electrons as they are transferred in biological systems?
6. Why is it thought that glycolysis is the first catabolic pathway to have evolved in the metabolism of all cellular systems?
7. Can a cell produce enough ATP to persist by using glycolysis alone?  Why or why not?
8. Why do anaerobic cellular systems use fermentation?  What would happen if they didn’t?
9. Why do mammalian muscle cells perform lactic acid fermentation (instead of, say, ethanol fermentation)?

**Things You Should Make Sure You Understand:**

* The energy processing strategies of each of the following modes of nutrition, and example organisms that engage in each mode:
  + Heterotrophs
  + Photosynthetic Autotrophs
  + Chemosynthetic Autotrophs
* Why food molecules need to be broken down into smaller molecules for energy to be harvested from them.
* The molecule that is oxidized and the molecule that is reduced in any REDOX reaction.
* The starting materials, end products and eventual fates of all of the molecules used and produced in glycolysis, lactic acid fermentation and ethanol fermentation.

**Part 2:  Aerobic Cellular Respiration and Control**

**Questions to answer:**

1. Why are pyruvate converted into acetyl-coA prior to entering the Kreb’s cycle?  What does this conversion do to the pyruvate molecules?
2. Oxygen is not used in the Kreb’s cycle, so why must the Kreb’s cycle occur in aerobic cellular respiration?
3. Where in the mitochondria does oxidative phosphorylation occur?  Why does it occur there?
4. What products of the prior phases of cellular respiration are used in the electron transport chain?  How are they used?
5. Diagram the movement of an electron through the electron transport chain in a mitochondrion.  Include its source, destination, and all products made directly and indirectly.
6. Compare and contrast the processes of chemiosmosis in aerobic cellular respiration and photosynthesis.
7. How much more energy is produced by aerobic cellular respiration than by anaerobic cellular respiration?
8. Estimate the efficiency of aerobic cellular respiration of a molecule of glucose:

Energy of formation of ATP from ADP:  ~ + 57 KJ/Mol

Energy of combustion of glucose:  ~ - 2805 KJ/Mol

1. Compare and contrast the metabolism of glucose with the metabolism of complex carbohydrates, Proteins & Fats.  Explain where each molecule (or component of the molecule) enters the aerobic cellular respiration pathway, and order each in terms of the amount of energy they produce for the cell.
2. Explain the effect of each of the following substances on phophofructokinase, and the overall effect they have on cellular respiration, and the system logic of each effect:
   1. AMP
   2. Citrate
   3. ATP

**Things You Should Make Sure You Understand:**

* The starting materials, end products, and eventual fates of all of the molecules used and produced in the acetyl-coA cycle, the Kreb’s cycle and oxidative phosphorylation.
* The relationship between the evolution of photosynthesis, the evolution of oxidative phosphorylation, and the evolution of multi-cellular life.
* The meaning of the term “proton-motive force”.
* The relationship between the catabolic pathways of cellular respiration and the anabolic pathways of biosynthesis.