**Part 1: Chemistry**

**Questions to answer:**

1. How common are the elements that living systems are made out of?
2. Explain the relationship between matter and energy.
3. Why do atoms bond?
4. What is the cause of molecular polarity?
5. How does the type of bonds present in a substance influence the chemical and physical properties of that substance?
6. If the breaking of bonds requires an input of energy (which it always does), how is it possible that some chemical reactions (like the burning of gasoline, for instance) can release energy into the environment?
7. How do the properties of a compound like H2O or NaCl illustrate the concept of emergent properties?
8. Why are radioactive elements useful for the study of biological systems?

**Things you should make sure you understand:**

**(feel free to ask questions about them in class)**

* The periodic location, atomic number, number of valence electrons, and biological utility of  S,P,O,N,C,H, along with Ca, K, Na, & Cl.
* How energy interacts with atoms.
* The differences between ionic and covalent bonds.
* How to identify if a substance is covalent (molecular) or ionic.
* Basic differences between covalent and ionic substances
* How to identify if a molecule is polar or non-polar.
* How to determine the intermolecular forces that will exist in a substance.
* The cause of radioactivity.

**Part 2:  Water**

**Questions to answer:**

1. Why are living things mostly made of water?
2. Draw a water molecule and indicate its polarity.
3. Explain how the structure of water molecules account for each of the following properties:
   1. Cohesion
   2. Adhesion
   3. High Specific Heat
   4. Floating Ice
   5. Good Solvent Properties
   6. Dissociation of water molecules
4. Explain 1 way that each of the above properties are useful for living systems.
5. Explain the relationship between the dissociation of water and the pH of a particular aqueous solution.

**Things you should make sure you understand:**

**(feel free to ask questions about them in class)**

* The absolute need for water in terrestrial living systems.
* How the properties of water demonstrate the concept of emergence.
* How to determine the pH of a solution if given the concentration of hydronium or hydroxide ions.

**Part 3:  Carbon**

**Questions to answer:**

1. Why is carbon central to the structure of all biological molecules?
2. Explain the concept of an isomer.  As the number of carbon atoms in a molecule increases, what happens to the number of possible isomers of that molecule?
3. Why is it significant that all biological systems use L-amino acids and D-sugars?
4. Draw each of the following functional groups:
   1. Hydroxyl
   2. carbonyl (ketone)
   3. carbonyl (aldehyde)
   4. carboxyl
   5. amino
   6. sulfhydryl
   7. methyl
   8. phosphate
5. Why are molecules that contain carboxyl groups acidic?
6. Why are molecules that contain amino groups basic?
7. How large a change to the structure of an organic molecule has to be made for that molecule to have a major difference in its effect on a living system?

**Things you should make sure you understand:**

**(feel free to ask questions about them in class)**

* Why carbon is such a versatile atom.
* The different types of isomers that can exist.
* The properties of all of the functional groups in question #4.