# **Chemistry of Living Things Discussion Guide (for use during or after reading)**

1. What are the four major elements of life and why are they important? (Elements of Living Things, p. 8-13)
   1. The four major elements of life are carbon, hydrogen, oxygen, and nitrogen. They are important to life because they form multiple chemical bonds, and can easily chain together to make long, complex molecules.
2. Describe the basic structure and purpose of nucleic acids. (Nucleic Acids, p. 16-21)
   1. Nucleic acids are the instructions that tell cells in living things when and how to make the proteins they need to survive and grow. Nucleic acids are made of smaller nucleotides, which include three functional groups: a phosphate, a sugar, and a group of compounds called bases. Each base can store one piece of information, so they chain together to create more detailed instructions.
3. Compare the two kinds of nucleic acids. (Nucleic Acids, p. 16-21)
   1. There are two types of nucleic acids: DNA (deoxyribonucleic acid) and RNA (ribonucleic acid). DNA is a chainlike molecule found in every living cell. It directs the formation, growth, and reproduction of cells and organisms. DNA includes two chains that twist in a ladder to form a double helix. It holds thousands of sections called genes, which are the units of code that determine every trait passed on to a living thing by its parents.
   2. RNA is a complex molecule that comes in in single-sided chains. Unlike DNA, RNA is able to leave the nucleus of a cell and carry instructions from DNA to the rest of the cell.
4. In general, what role do carbohydrates play in living things? (Carbohydrates, p. 22-23)
   1. In general, carbohydrates are used to store energy in living things. They can form monosaccharides, bond with each other to become disaccharides like those found in some sugars, or create long strips called polysaccharides.
5. How do phospholipids form lipid bilayers and what role do they play in living things? (Lipids, p. 24-26)
   1. Lipids are a large group of oily, fatty, or waxy substances. Phospholipids have a phosphate functional group at one end and two fatty acid chains on the other. Phosphates are attracted to water, whereas fatty acids repel it. This allows the lipids to automatically arrange themselves into a lipid bilayer, which can act as a wall in a living cell. Lipid bilayers form cell membranes and keep unwanted substances outside of the cells.
6. Why might some people consider amino acids to be the building blocks of protein? (Amino Acids: The Building Blocks of Proteins, p. 27-30)
   1. Some people may consider amino acids to be the building blocks of proteins because they are tiny molecules that chain together to form proteins, just as blocks can be stacked together to create a tower. Each amino acid has a unique side chain, an amino group, and a carboxyl group that connect to a central carbon atom. They chain together to form a variety of proteins and can even attach to other protein chains.
7. What role(s) do proteins play in the cells of living things? (Amino Acids: The Building Blocks of Proteins, p. 27-30)
   1. Proteins make up large parts of living cells. They play crucial roles in cell function and survival. For example, the cell membrane uses proteins to determine which molecules to let in and out of the cell. In addition, proteins in the cell help it hold its shape, and they can even fight disease!
8. Describe how enzymes work in cells to speed up the chemical reactions they need to function, repair themselves, and reproduce. (Enzymes, p. 31-32)
   1. Enzymes are a family of biomolecules that speed up chemical reactions in all living things. Enzymes have unique shapes that allow them to attach to certain molecules, their reactants. They combine with the reactants and split them to create products. The enzymes then repeat this process inside the living cell.
9. Compare the process of glycolysis to the process of cellular respiration. (ATP and Cellular Respiration, p. 33-35)
   1. Sometimes, cells in living things need energy. One way in which cells can produce energy is through the process of glycolysis, where they break down sugars. Glycolysis produces some energy, but not enough needed for living things that are more complex than bacteria. Plants and animals use another process to produce the energy their cells need. Plant and animal cells contain organelles called mitochondria. These organelles combine molecules from food and oxygen in the air to produce energy through cellular respiration. This process not only creates energy for the cell, but also creates water and carbon dioxide. In addition, cellular respiration recharges ATP used for energy in cells.
10. Describe the role of chloroplasts in photosynthesis. (Photosynthesis, p. 36)
    1. Chloroplasts are organelles found in plant cells that use light energy to combine carbon dioxide with water molecules to create sugars. The plant uses some sugars to build its tissues but breaks most of them down via cellular respiration to make energy.