

## AP & IB Biology Summer Assignment:

Mrs. Unger

In the AP Edition textbook, Biology, by Campbell & Reece, read chapters 2-5 and answer the objective questions for each chapter listed below. The questions are due on **Orientation Day**. I will spend the first 2-3 days of classes answering any questions that you may have about the material and highlighting key principles. **A test will be given within the first week of school on this unit.**

### Ch. 2 - The Chemical Context of Life

1. Distinguish between an element and a compound.
2. Identify the 4 elements that make up 96% of living matter.
3. Sketch an atom of carbon showing the location and number of electrons, protons, and neutrons. List the atomic number, atomic mass, and valence.
4. List 3 examples of how radioactive isotopes can be useful to biologists.
5. For each of the following elements, *S*, *Ca*, *P*, *Fe*, and *Na*, state a role in plants, animals, and prokaryotes. The role can be same for all three groups.
6. What influences the chemical behavior (bonding capabilities) of an atom?
7. Distinguish among nonpolar covalent, polar covalent, and ionic bonds.
8. Describe a hydrogen bond.
9. Describe how a molecule's shape influences its biological function, using a specific enzyme-substrate complex as an example.

### Ch. 3 - Water and the Fitness of the Environment

1. Explain the relationship between the polar nature of water and its ability to form hydrogen bonds. Draw and label a sketch between 2 water molecules to support your explanation.
2. As a result of water's polarity and its ability to form hydrogen bonds with other polar or charged molecules, water has the following properties:
  - a. H<sub>2</sub>O molecules are cohesive; they form hydrogen bonds with each other
  - b. H<sub>2</sub>O molecules are adhesive; they form hydrogen bonds with polar surfaces
  - c. Water is an excellent solvent and remains liquid at normal physiological (or body) temperatures
  - d. Water's greatest density occurs at 4°C
  - e. Water's ability to moderate temperature; Water has a high heat of vaporization & a high specific heat

Explain how these properties of water are related to the phenomena described in parts f-i below. More than one property may be used to explain a given phenomenon.

- f. Many substances - for example, salt and sucrose - dissolve quickly in water
  - g. Sweating and the evaporation of sweat from the body surface help reduce a human's body temperature
  - h. If you touch the edge of a paper towel to a drop of colored water, the water will move up into (or be absorbed by) the towel.
  - i. During the winter, air temperatures in the northern U.S. can remain below 0°C for months; however, the fish and other animals living in the lakes survive.
3. Write the equation for the dissociation and re-formation of water.
  4. What does pH measure? Describe the pH scale.
  5. Using the bicarbonate buffer system as an example, explain how buffers work.
  6. Describe the causes of acid precipitation and how it affects the environment.

#### Ch. 4 - Carbon and the Molecular Diversity of Life

1. Explain how carbon's electron configuration determines the kinds and numbers of bonds that carbon will form.
2. Name the major functional groups and describe the chemical properties of the organic molecules in which they occur. For example, does its presence make a molecule polar or nonpolar, hydrophilic or hydrophobic.

#### Ch. 5 - The Structure and Function of Macromolecules

1. Explain the processes of making and breaking down polymers.
2. List the 4 major classes of macromolecules.
3. Sketch glucose and ribose.
4. Sketch sucrose, highlighting a glycosidic linkage.
5. List 4 examples of polysaccharides and state the function of each.
6. How are starch and cellulose structurally different and how does this difference impact biological systems?
7. Describe the unique properties, building block materials, and biological importance of the following groups of lipids: fats, phospholipids, and steroids.
8. Sketch a triglyceride, highlighting an ester linkage.
9. Distinguish between a saturated and unsaturated fat and list some emergent properties that are a consequence of these structural differences.
10. Compare carbohydrates and lipids in terms of their advantages as energy storage molecules.
11. Sketch a dipeptide, highlighting a peptide bond.
12. Proteins perform a multitude of functions for organisms. Copy and Complete the table below:

Type of Protein	Function	Specific Example
1.		
2.		
3.		
4.		
5.		

13. Sketch a DNA molecule that is 4 base pairs long and label all parts.
14. Distinguish between a pyrimidine and purine.
15. Describe the relationship between DNA and proteins?

16. **Write an Essay:** Modified from 2008 AP exam.

The physical structure of a protein often reflects and affects its function.

- (a) Describe THREE types of chemical bonds/interactions found in proteins. For each type, describe its role in determining protein structure
- (b) Discuss how the structure of a protein affects the function of ONE of the following:
  - Regulation of enzyme activity
  - Cell signaling
- (c) Abnormal hemoglobin is the identifying characteristic of sickle cell anemia. Explain the genetic basis of the abnormal hemoglobin. Explain why sickle cell allele is selected for in certain areas of the world.

17.

**Part A.** Copy and complete the table below by listing distinguishing characteristics that can be used as rules to help you identify each of the macromolecules.

Carbohydrates	
Lipids	
Proteins	
Nucleic Acids	

**Part B. Carbohydrate, lipid, protein, or nucleic acid? Name that structure!**

Based on the rules you developed in Part A, identify the compounds below (and on the following page) as carbohydrates, lipids, amino acids, polypeptides, or nucleic acids. In addition, indicate whether each is likely to be polar or nonpolar, hydrophilic or hydrophobic.

