AP Biology Summer Assignment – 2023

Welcome to AP Biology! This packet includes instructions for assignments that are to be completed over the summer in preparation for beginning the course in the fall. These assignments cover Unit I of the course: Introduction and the Chemistry of Life. This unit encompasses the first 3 chapters of the textbook (*Campbell Biology in Focus*, by Lisa Urry *et al.*) Most of these initial assignments involve chemistry and biochemistry, which should be a review for you. We will have a test on unit 1 within the first two weeks of school in August. It is important to note that we will spend very little time in class reviewing this material — so you should study these chapters and do these assignments accordingly. And remember — an AP course is supposed to be college level, so I will expect well-thought-out and well-written answers and explanations.

Some of these assignments require you to read the textbook and answer content questions. They are designed to focus your attention on some of the important aspects of each chapter.

Included also in this packet is a question designed to simulate a free-response type question from the AP exam. It requires you to analyze data, construct a graph, and draw conclusions.

All work is to be completed neatly and submitted in a well-organized manner. It should be **your own work, without collaboration from other students. It will be collected on the first full day of school.**

Enjoy your summer!

Dr. Morton

An Introduction to AP Biology: The Four "Big Ideas"

The AP Biology course curriculum is organized around four major concepts that influence all biological topics. These major concepts are called "Big Ideas" by the AP College Board in their description of the AP Biology curriculum. You should be able to recognize evidence of these major concepts throughout the year as we cover different topics.

The "Big Ideas" are summarized as follows:

Big Idea 1. The process of evolution drives the diversity and unity of life.

Big Idea 2. Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

Big Idea 3. Living systems store, retrieve, transmit and respond to information essential to life processes.

Big Idea 4. Biological systems interact, and these systems and their interactions possess complex properties.

ALL QUESTIONS ARE TO BE ANSWERED IN COMPLETE SENTENCES, NEATLY HANDWRITTEN ON LOOSELEAF, OR TYPED.

Part I. Unit 1 Review Questions

Chapter 1. Introduction: Evolution and the Foundation of Biology

1. Briefly EXPLAIN each of the four "Big Ideas" of the AP Biology Curriculum in your own words. Each explanation should be more than a single sentence.

2. Select one of the "Big Ideas" of the curriculum of the AP Biology Course. By looking through your textbook, EXPLAIN how it pertains to Animals, Plants, and Bacteria. That is, write a few sentences about how your selected "Big Idea" relates to some specific aspect of **each** of the following: Animals, Plants, and Bacteria.

3. Three important themes connecting all aspects of biology are (a.) evolution, (b.) unity and diversity, and (c.) the relationship between structure and function. EXPLAIN what these themes mean.

Chapter 2. The Chemical Context of Life

1. TABLE: Types of Chemical Bonds – fill in the required information.

Bond Type	**Defining Characteristics of the Bond Type**	**What Structures Participate in this Bond? (Atoms, ions, compounds?)**	**List 2 Examples of Biological Molecules/Compounds that Have This Type of Bond**
Non-polar covalent			
Polar covalent			
Ionic			
Hydrogen bond			

2. DRAW 5 water molecules and the hydrogen bonds connecting them. LABEL 1 hydrogen bond and 1 polar covalent bond.

3. LIST four emergent properties of water and explain how they are derived. That is, explain how the molecular structure of the water molecule gives rise to these properties. An emergent property is a property of an object that is characteristic of the whole but not characteristic of its parts (see page 33 of text for further discussion).

4. DEFINE pH. What does it tell you? How is it determined? If the pHs of two solutions differ by 1 pH point, what does that say about their relative concentrations of H^+? What if the two solutions differ by 2 or 3 pH points?

Chapter 3: Carbon and the Molecular Diversity of Life

1. Carbon-based molecules exhibit vast molecular diversity. For each of the 4 classes of organic compounds listed below, EXPLAIN the basis of molecular diversity within the class. That is, explain how the structure of the following classes of molecules allows for the many diverse types of molecules in each class:

- Carbohydrates
- Lipids
- Proteins
- Nucleic acids

2. Fill in the table with the appropriate information:

Class	**Monomers (Subunits used to build the polymers)**	**Function(s)**	**Biological Examples**
Carbohydrates			
Lipids			
Proteins			
Nucleic Acids			

Part II: Simulated Free Response

1. A biochemist is interested in the effect of a particular enzyme on the chemical reaction that it catalyzes. He measures the reaction rate both in the presence and absence of the enzyme at different temperatures. Data describing the rate of the reaction with and without the enzyme are provided in the table below. Rates are represented in units (mmol) of product produced per second. You will construct a graph of these data and then use that graph to formulate answers to the questions that follow. Consult your textbook — read the sections about enzyme function and the scientific method.

Reaction Rates with and without an enzyme at different temperatures.				
Temperature (^{o}C)	15	25	35	45
Reaction Rate — Enzyme Absent (mmol/sec)	0.01	0.02	0.03	0.04
Reaction Rate — Enzyme Present (mmol/sec)	1.0000	2.5000	4.0000	0.04

a) Using **graph paper (**points will be deducted if graph paper is not used), construct a line graph (connect the points) of the data provided. The X-axis is temperature and the Y-axis is reaction rate. Your graph should have 2 lines: one representing the reaction without the enzyme, and the other representing the reaction when the enzyme is present. Make sure the **axes are drawn and labeled, the units are indicated, the axes are scaled appropriately, and your graph has a descriptive title.**

b) What is the investigator looking for when he is studying the effect of the enzyme? What would be an appropriate hypothesis for this experiment? What is the independent variable? What is the dependent variable? What is the control?

c) Examine your graph (NOT the table). What can you conclude about the presence or absence of the enzyme? What can you conclude about the effect of changing temperatures? Be specific in explaining how you know.

d) Recall that enzymes are proteins. Explain why there is a difference between the reaction rates with and without the enzyme at temperatures of 15 ^{0}C, 25 ^{0}C, and 35 ^{0}C, but no difference between the two reaction rates at 45 ^{0}.