

AP BIOLOGY SUMMER ASSIGNMENT

Unit 1: Chemistry of Life

Chapters: 1-5

Welcome to AP Biology!

The two main goals of AP Biology are to help you develop a conceptual framework for modern biology and to gain a deeper appreciation of science as a process (as opposed to an accumulation of facts). Because of the rapid pace of discovery in the life sciences our primary emphasis is on developing an understanding of unifying concepts that connect the major topics of biology. The AP Biology Curriculum centers around the four Big Ideas and you will need to not only know these but also understand how they all relate:

- **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.**

In addition the curriculum focuses on 7 Science Practices which you will be held responsible for being able to do:

- **Science Practice 1:** The student can use representations and models to communicate scientific phenomena and solve scientific problems.
- **Science Practice 2:** The student can use mathematics appropriately.
- **Science Practice 3:** The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
- **Science Practice 4:** The student can plan and implement data collection strategies appropriate to a particular scientific question.
- **Science Practice 5:** The student can perform data analysis and evaluation of evidence.
- **Science Practice 6:** The student can work with scientific explanations and theories.
- **Science Practice 7:** The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains.

What to do before the first day of school:

- AP Biology was designed by a select group of college professors and high school science teachers to be equivalent to an introductory college biology course. Visit the below College Board site to explore what an AP Biology course is like:
 - <https://apstudent.collegeboard.org/exploreap?affiliateId=apcentral&bannerId=exploreap1>
- We have a small problem in AP Biology. Each year new advances in science are discovered but the length of the school year (and when the test occurs) stays the same. What does this mean? We are short on time. In order to cover ALL of the material, you are responsible for reviewing the Chemistry section on your own.

- Here is what you are to do:
 - **Watch the following YouTube videos.** Get to know these guys as we will tune into them quite a bit during the year. These videos are great chemistry reviews.
 - These are called Crash Courses with Hank Green. Watch Biology #1 and #2
<http://www.youtube.com/playlist?list=PL3EED4C1D684D3ADF&feature=plpp>
 - These are called Bozeman Science with Paul Anderson. In addition to having content videos he also has plenty of information on the AP Exam and curriculum. So even though I'm only assigning Chemistry video's now you might want to check out some of the other ones.
<http://www.bozemanscience.com/ap-biology/>
For now go to the following website and watch "Mole Conversions" and "Water a polar molecule"
<http://www.bozemanscience.com/chemistry/>
 - **Print and answer the Guided Reading Questions(chapters 1-4):** As an AP student it is important that you are capable of properly reading and gaining information from a science text book.
 - Preview the chapter and focus on:
 - a. **Key Concepts:** (noted at the beginning of the chapter)
 - b. **Concept questions:** Concisely answer the questions. Get to the main point and don't copy every sentence as you can use these as a study aid in preparation for the AP Exam.
 - c. **Vocabulary Term:** Define the key terms so that **you** understand their meaning. *Correctly use as many as possible while answering the concept questions.* (You might want to make some type of vocabulary list or flashcards to use when you review for the AP Exam in May)
 - d. **Graphics:** (read the captions and see if you understand the figure) You can gain much understanding from simply looking at the "pictures" and captions in a textbook.
 - e. **Summary of Key Concepts:** Read thoroughly at the end of each chapter.
 - **Print and complete the Chemistry Review(Attached).** As an AP Biology student the expectation is that if you don't know it, find it out!! Use all of your resources!!!
 - **Print and complete the Biology Prefixes and Suffixes(attached).** Because vocabulary in this course can be a stumbling block, you need to take some time to review the scientific Latin/Greek roots that form many of our scientific terms. It will make life in AP Biology much easier if you KNOW these roots.
 - **Print and complete the BioCoach Activity on Building BioMolecules(attached):** This is where we will begin in our Chemistry of Life Unit after a couple of quick labs on water and buffers. This is an excellent introduction connecting Chemistry with Biology.
- Be prepared for a quiz during the first couple of days!!! This quiz will be on Chemistry and some common biology terms (made from the prefixes and suffixes).

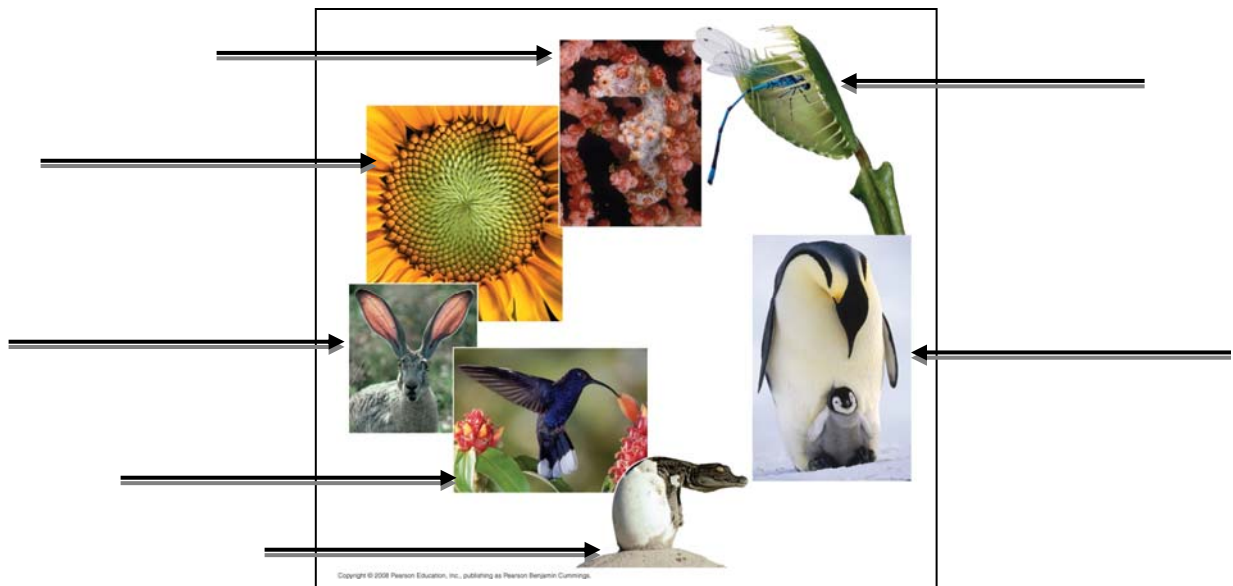
I truly am looking forward to working with you next year! Don't procrastinate on this assignment but don't let it keep you from having a wonderful summer!!!

Name _____ Period _____

Chapter 1: Introduction: Themes in the Study of Life

Begin your study of biology this year by reading Chapter 1. It will serve as a reminder about biological concepts that you may have learned in an earlier course and give you an overview of what you will study this year.

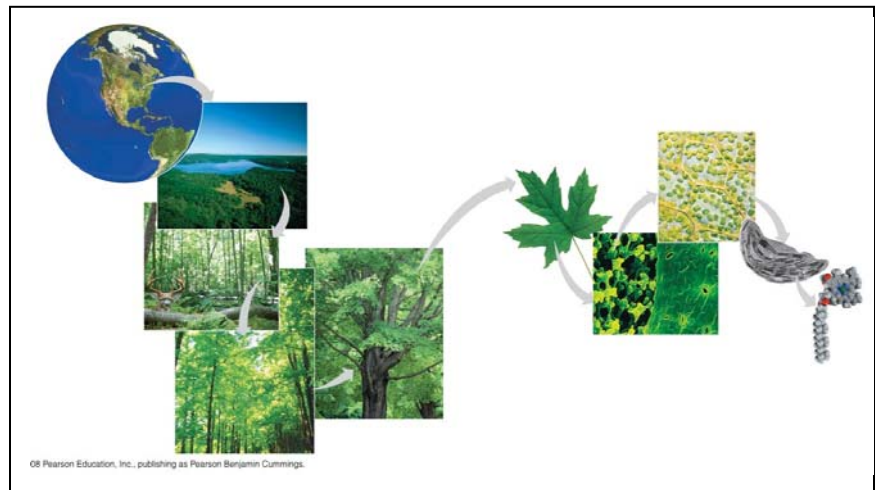
1. In the overview, Figure 1.3 recalls many of the properties of life. Label the seven properties illustrated here, and give a *different* example of each.



Concept 1.1 Themes connect the concepts of biology

2. What are **emergent properties**? Give two examples.

3. Life is organized on many scales. Figure 1.4 zooms you in from viewing Earth from space all the way to the level of molecules. As you study this figure, write in a brief definition of each level.



biosphere

ecosystem

community

population

organism

organs/organ systems

tissues

cells

organelles

molecules

4. Our study of biology will be organized around recurring themes. Make a list here of the themes that are presented, and give an example that illustrates each theme. Watch for these themes throughout your study this entire year. This will help you see the big picture and organize your thinking. (Go to the *Summary of Key Concepts* at the end of the chapter for a concise look at the themes.)

<i>Theme 1</i>	<i>Example</i>
<i>Theme 2:</i>	
<i>Theme 3:</i>	
<i>Theme 4:</i>	
<i>Theme 5:</i>	
<i>Theme 6:</i>	
<i>Theme 7: (Find it in 1.2.)</i>	

5. As you read this section, you will be reminded of things you may have studied in an earlier course. Since this material will be presented in detail in future chapters, you will come back to these ideas, so don't fret if some of the concepts presented are unfamiliar. However, to guide your study, define each of the terms in bold as you come to them.

eukaryotic cell

prokaryotic cell

DNA

genes

genome

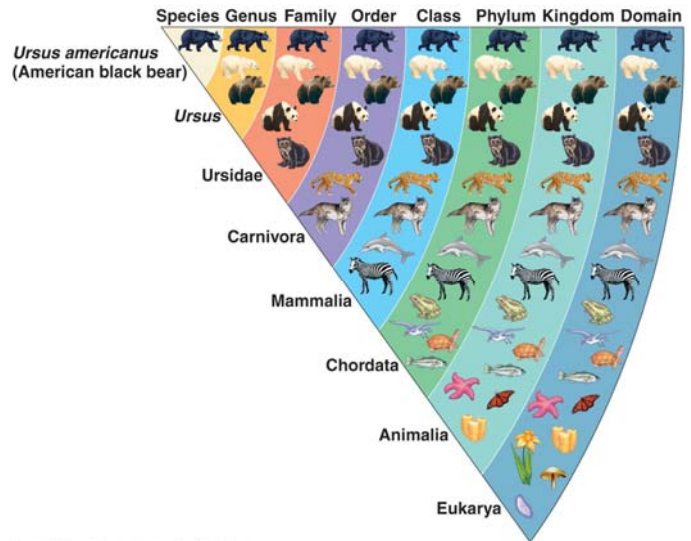
negative feedback/positive feedback

Concept 1.2 The Core Theme: Evolution accounts for the unity and diversity of life

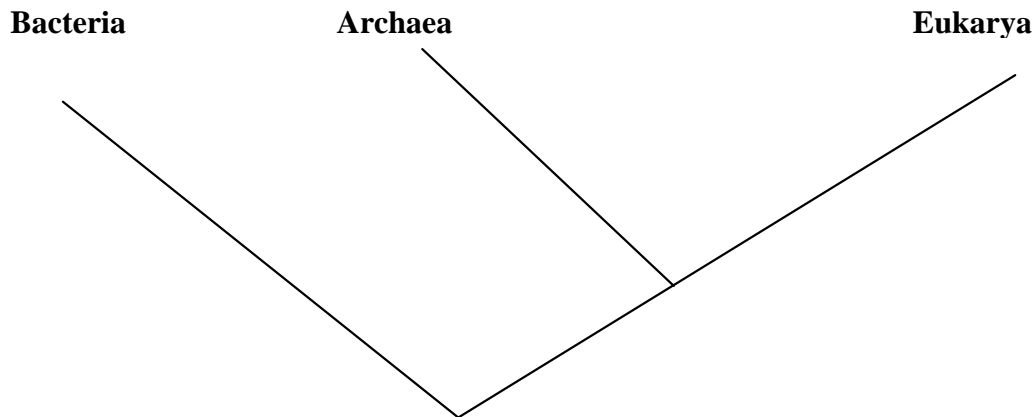
6. Life is organized into groups. Study Figure 1.14.

- Which level contains the greatest diversity of organism?
- The least?
- Write out the levels of organization in order.

- Most people use a mnemonic device to remember these levels. If you have one, write it here.

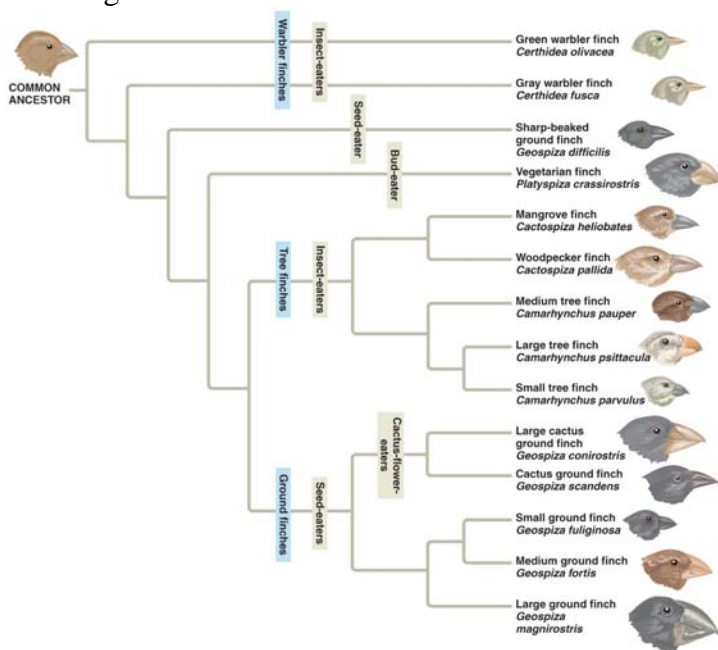


7. Taxonomy is the branch of biology that names and classifies organisms. Because of new molecular information, there have been many changes in placement of certain groups in recent years. Notice that all life is now organized in your text into 3 domains rather than the 5 kingdoms you may have learned earlier. Put the kingdoms mentioned in the text in the space above the proper domain names shown here.



8. What two main points were articulated in Darwin's *The Origin of Species*?
9. What did Darwin propose as the mechanism of evolution? Summarize this mechanism.

10. Study Figure 1.22, which shows an evolutionary "tree." What is indicated by each twig? What do the branch points represent? Where did the "common ancestor" of the Galápagos finches originate?



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Concept 1.3 Scientists use two main forms of inquiry in their study of nature

11. What are the two main types of scientific inquiry? Give an example of each.

12. What is *data*?

13. Distinguish between quantitative and qualitative data. Which type would be presented in a data chart and could be graphed? Which type is found in the field sketches made by Jane Goodall?

14. In science, how do we define *hypothesis*?

15. A scientific hypothesis has two important qualities. The first is that it is *testable*. What is the second?

16. Are scientific hypotheses proved? Explain your answer!

17. Look at Figure 1.24. Use it to write a hypothesis using the “If . . . then . . .” format.

18. What is a *controlled experiment*?

19. The text points out a common misconception about the term “controlled experiment”. In the snake mimicry experiment, what factors were held *constant*?

20. Why are supernatural explanations outside the bounds of science?

21. Explain what is meant by a scientific *theory* by giving the three ways your text separates a theory from a hypothesis or mere speculation.

1.

2.

3.

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

Name _____ Period _____

Chapter 2: The Chemical Context of Life

This chapter covers the basics that you may have learned in your chemistry class. Whether your teacher goes over this chapter, or assigns it for you do review on your own, the questions that follow should help you focus on the most important points.

Concept 2.1 Matter consists of chemical elements in pure form and in combinations called compounds

1. Define and give an example of the following terms:
matter

element

compound
2. What four elements make up 96% of all living matter?
3. What is the difference between an *essential element* and a *trace element*?
essential element

trace element

Concept 2.2 An element's properties depend on the structure of its atoms

4. Sketch a model of an atom of helium, showing the electrons, protons, neutrons, and atomic nucleus.
5. What is the atomic number of helium? _____ Its atomic mass? _____
6. Here are some more terms that you should firmly grasp. Define each term.
neutron

proton

electron

atomic number

atomic mass

isotope

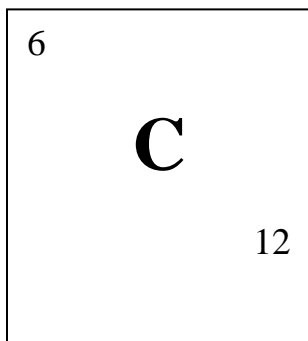
electron shells

energy

7. Consider this entry in the periodic table for carbon.

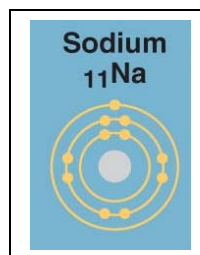
What is the atomic mass? _____ atomic number? _____

How many electrons does carbon have? _____ neutrons? _____



8. Which is the only subatomic particle that is directly involved in the chemical reactions between atoms?
9. What is *potential energy*?
10. Explain which has more potential energy in each pair:
- a. boy at the top of a slide/boy at the bottom
 - b. electron in the first energy shell/electron in the third energy shell
 - c. water/glucose

11. What determines the chemical behavior of an atom?
12. Here is an electron distribution diagram for sodium:
- a. How many valence electrons does it have? _____ Circle the valence electron(s).
- b. How many protons does it have? _____



Concept 2.3 The formation and function of molecules depend on chemical bonding between atoms

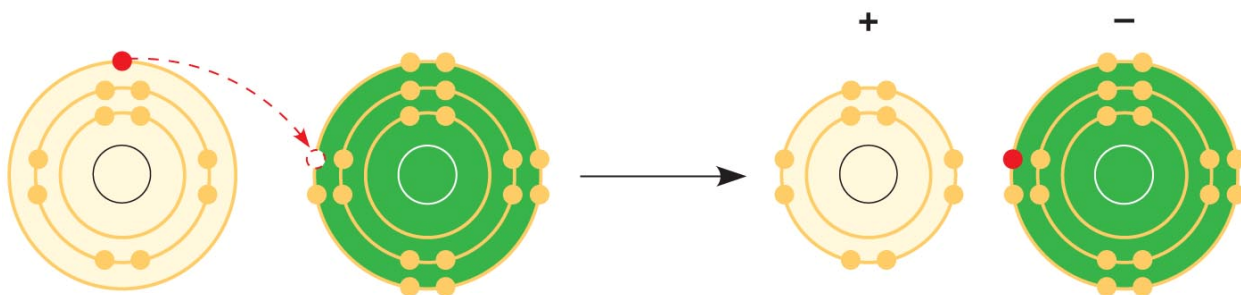
13. Define *molecule*.
14. Now, refer back to your definition of a *compound* and fill in the following chart:

	Molecule? (y/n)	Compound? (y/n)	Molecular Formula	Structural Formula
Water				
Carbon dioxide				
Methane				
O ₂			O ₂	

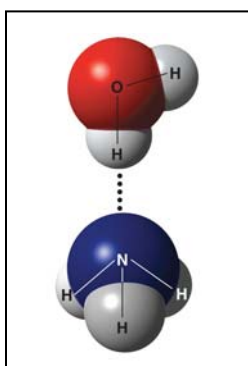
15. What type of bond is seen in O₂? Explain what this means.
16. What is meant by *electronegativity*?
17. Explain the difference between a *nonpolar covalent bond* and a *polar covalent bond*.

18. Make an electron distribution diagram of water. Which element is most electronegative? Why is water considered a *polar* molecule? Label the regions that are more positive or more negative. (This is a very important concept. Spend some time with this one!)

19. Another bond type is the *ionic bond*. Explain what is happening in the figure below (2.14):



20. What two elements are involved above?
21. Define *anion* and *cation*. In the preceding example, which is the anion?
22. What is a *hydrogen bond*? Indicate where the hydrogen bond occurs in this figure.



23. Explain *van der Waals interactions*. Though they represent very weak attractions, when these interactions are numerous they can stick a gecko to the ceiling!

24. Here is a list of the types of bonds and interactions discussed in this section. Place them in order from the strongest to the weakest: hydrogen bonds, van der Waals interactions, covalent bonds, ionic bonds.

STRONG



WEAK

25. Use morphine and endorphins as examples to explain why molecular shape is crucial in biology.

Concept 2.4 Chemical reactions make and break chemical bonds

26. Write the chemical shorthand equation for photosynthesis. Label the *reactants* and the *products*.
27. For the equation you just wrote, how many molecules of carbon dioxide are there? _____
How many molecules of glucose? _____ How many elements in glucose? _____
28. What is meant by *dynamic equilibrium*? Does this imply equal concentrations of each reactant and product?

Testing Your Knowledge: Self-Quiz Answers

Now you should be ready to test your knowledge. Place your answers here:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____