Name: Hour:

Biology Root Words/Suffixes

Biology contains root words/suffixes that come up continuously throughout the course. Learning these words now will make understanding new terms much easier throughout the year. Please memorize each of these root words/suffixes and be able to recognize the words/their meanings when the roots/suffixes are a part of actual words. You will be quizzed on these words (along with Chapter 1-4 material) on **TUESDAY, SEPTEMBER 10TH**. Getting these words memorized during the summer will make the first week of school much more enjoyable for you!

Chemistry of Life Reading Guide

The Chemistry of Life unit is technically a "prerequisite" to AP Biology. You have already learned most of these concepts in Honors Biology and/or Honors Chemistry. To account for this, we are going to get a head start on the year by completing this guided reading packet on Chapters 1-4 and flying through concepts you should already be pretty familiar with. Feel free to use your textbook and your Pearson Holtzclaw test prep book to help you. This packet will be due the SECOND WEEK OF SCHOOL: **TUESDAY, SEPTEMBER 10TH**, which is also the day you will have a quiz on this material. I would recommend finishing it earlier than this due date if possible so you have time to actually study the material before the quiz itself (hence why you have all of summer to do it). You do NOT need to write in complete sentences as long as your answer is fully expressed.

Chapter 1

1. Chapter 1 gives an overview of the 5 main themes that our AP Biology course will cover: Organization, Information, Energy and Matter, Interactions, and Evolution. The AP Curriculum further groups these themes into **4 "Big Ideas": Evolution, Energetics, Information Storage and Transmission, and Systems Interactions**. We will be splitting these 4 Big Ideas into 8 units during the course of our year. Complete the table below by finding associated topics that correspond to each Big Idea. You should have at least 10 topics associated with each Big Idea.

Biology Theme	Topics Associated with this Theme
BIG IDEA 1: EVOLUTION (EVO) **The process of evolution drives the diversity and unity of life.** Evolution is a change in the genetic makeup of a population over time, with natural selection as its major driving mechanism. Darwin's theory, which is supported by evidence from many scientific disciplines, states that inheritable variations occur in individuals in a population. Due to competition for limited resources, individuals with more favorable genetic variations are more likely to survive and produce more offspring, thus passing traits to future generations. A diverse gene pool is vital for the survival of species because environmental conditions change. The process of evolution explains the diversity and unity of life, but an explanation about the *origin* of life is less clear. In addition to the process of natural selection, naturally occurring catastrophic and human-induced events as well as random environmental changes can result in alteration in the gene pools of populations. Scientific evidence supports that speciation and extinction have occurred throughout Earth's history and that life continues to evolve within a changing environment, thus explaining the diversity of life.	

BIG IDEA 2: ENERGETICS (ENE) **Biological systems use energy and molecular building blocks to grow, reproduce, and maintain dynamic homeostasis.** Cells and organisms must exchange matter with the environment. Organisms respond to changes in their environment at the molecular, cellular, physiological, and behavioral levels. Living systems require energy and matter to maintain order, grow, and reproduce. Organisms employ various strategies to capture, use, and store energy and other vital resources. Energy deficiencies are not only detrimental to individual organisms but they can cause disruptions at the population and ecosystem levels. Homeostatic mechanisms that are conserved or divergent across related organisms reflect either continuity due to common ancestry or evolutionary change in response to distinct selective pressures.	
BIG IDEA 3: INFORMATION STORAGE AND TRANSMISSION (IST) **Living systems store, retrieve, transmit, and respond to information essential to life processes.** Genetic information provides for continuity of life, and, in most cases, this information is passed from parent to offspring via DNA. Nonheritable information transmission influences behavior within and between cells, organisms, and populations. These behaviors are directed by underlying genetic information, and responses to information are vital to natural selection and evolution. Genetic information is a repository of instructions necessary for the survival, growth, and reproduction of the organism. Genetic variation can be advantageous for the long-term survival and evolution of a species.	
BIG IDEA 4: SYSTEMS INTERACTIONS (SYI) **Biological systems interact, and these systems and their interactions exhibit complex properties.** All biological systems comprise parts that interact with one another. These interactions result in characteristics and emergent properties not found in the individual parts alone. All biological systems from the molecular level to the ecosystem level exhibit properties of biocomplexity and diversity. These two properties provide robustness to biological systems, enabling greater resiliency and flexibility to tolerate and respond to changes in the environment.	

2. AP Biology will include many labs that will make you think in new ways. To prepare you for some of these lab investigations, please answer the following questions.

    a. What is the idea of inquiry?

    b. What is data?

    c. What are some differences between qualitative and quantitative data?

d. How do we define a hypothesis?

e. Can a hypothesis be proven? Explain.

f. You notice that the daisies in your backyard are dying. To figure out why they are dying, you must first come up with a hypothesis to test out. Write a hypothesis to this observation of yours using the "if…then" format.

g. Look over Figure 1.23. This figure may look different than the scientific method you are used to seeing. What is different about this compared to the scientific method you may have seen in the past?

h. What is a controlled experiment? What is the difference between a control group and an experimental group?

i. Explain the difference between a dependent and independent variable. How would you see these variables plotted on a graph?

j. What are 3 ways that a theory is different from a hypothesis?

Chapter 2

Most Chapter 2 topics will be covered in your Chemistry of Life project. These questions only cover topics that are NOT included in your project.

3. What is the difference between an essential element and trace element?

4. What 4 elements make up 96% of all living matter?

5. What is an isotope? What are radioactive isotopes and what can radioactive isotopes be used for? (These isotopes will come up in a lot of experiments we study!)

6. Chemical bonds are interactions between the valence electrons of different atoms. How would you define valence electrons? After defining this, draw an atom of oxygen with electron shells filled with the proper number of electrons around it) and highlight the valence electrons.

7. Fill out the table below based on the defining features of ionic, covalent, and various weak bonds.

Type of Bond	Defining Features of this Bond	Example of Where This Bond is Seen
Ionic		
Covalent (Polar)		
Covalent (Nonpolar)		
Weak (Hydrogen)		
Weak (Van der Waals)		

8. The three most important bonds to know for this class are **polar covalent**, **nonpolar covalent**, and **hydrogen**. Answer the following questions about these bonds.

    a. Do polar covalent bonds happen within one molecule or between multiple molecules? Does this bond result in atoms having partial charges?

    b. Do nonpolar covalent bonds happen within one molecule or between multiple molecules? Does this bond result in atoms having partial charges?

c. Do hydrogen bonds happen within one molecule or between multiple molecules? Specifically, what kind of atoms can a hydrogen bond happen between? Are partial charges necessary for a hydrogen bond to form?

Chapter 3

9. Living systems depend on the properties of water that result from the polar covalent bonds found within water molecules and the hydrogen bonds that are found between water molecules. Below, draw four water molecules. Show their polarity by drawing in the partial positive and negative regions of each atom WITHIN each water molecule. Show their hydrogen bonds by drawing dashed lines precisely where these weak bonds form BETWEEN water molecules.

10. As mentioned in the previous question, water has many unique properties that allow life to be sustained due to its polarity and hydrogen bonding capabilities. In the table below, write out the defining features of each property given and give an example of where you see this property at work.

Properties of Water	Defining Features of this Property	Example of Where This Property is Seen
Cohesion		
Adhesion		
Surface Tension		

High Specific Heat		
Ability of Ice to Float		
Water as a Solvent		

11. Transpiration is the process where plants pull water up from roots to the underside of leaves where water can leave as water vapor (and therefore evaporate) through the stomata. Draw an image depicting this below. Describe how the principles of cohesion and adhesion allow this process of transpiration to occur. (We will be studying this process more closely in our first lab!)

12. Many Michigan lakes/ponds freeze over in the winter yet all the fish in these lakes/ponds survive. Use the property of "ice floating" to describe how fish can still survive even when lakes/ponds freeze.

13. Fill in the table about hydrophobic and hydrophilic substances:

Type of substance	Will this substance interact with water?	What kind of internal bonds does this substance have (ionic, polar covalent, or nonpolar covalent)?	Examples of this substance
Hydrophilic			
Hydrophobic			

14. Mini lab #1:
    a. Take out 2 small cups in your kitchen along with some kind of oil (vegetable oil, olive oil, etc.)
    b. In one cup add 4 ounces of water followed by 2 tablespoons of oil. Record your observations below and draw a picture of what you see happening:

    c. In the second cup add 2 tablespoons of oil followed by 4 ounces of water. Record your observations below and draw a picture of what you see happening:

    d. Was there a difference in your observations between you two cups? Explain.

    e. Is oil hydrophilic or hydrophobic? How do you know?

15. Mini lab #2:
    a. Take out 1 small cup along with salt (NaCl).
    b. Add 6-8 ounces of water into a cup along with 2 teaspoons of salt. Then stir.
    c. Record your observations below.

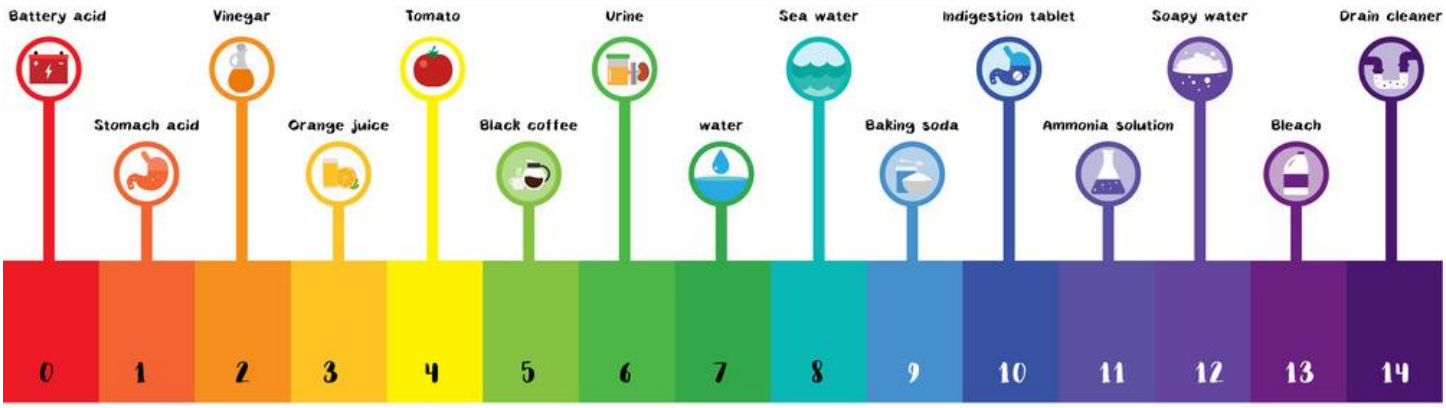
    d. Is salt hydrophilic or hydrophobic? How do you know?

    e. Draw a picture below to show how water interacts with salt via hydration shells.

    f. What is the solute in this example? What is the solvent? What do a solute and solvent together make?

16. Answer the following questions about pH:

    a. A pH scale runs between 0 and 14 and measures the acidity and alkalinity of a solution (AKA how acidic or basic a solution is). A pH of 7 is neutral. Label the acidic, neutral, and basic "zones" of the pH scale below. Pay attention to the examples associated with each zone.



b. When water breaks up, what two ions (charged molecules) does water break up into?

c. When a solution is acidic, which ion from "b" is there more of? What are common types of acidic solutions we may encounter in this course?

d. When a solution is basic, which ion from "b" is there more of? What are common types of basic solutions we may encounter in this course?

e. The equation for pH (which is on the AP Equation sheet) is pH = - log [H+]. While you do not need to do actual calculations on the AP test, you do need to know conceptually what the equation means. The brackets stand for the concentration of H+ ions in a solution. If the concentration of H+ ions in a solution is 0.0006 M (M is the unit used to represent concentration), what is the pH?

f. If the concentration of H+ ions in a solution is 0.000000009 M, what is the pH?

g. What is the difference in H+ concentration in a solution with a pH of 7 versus a pH of 9?

h. How many times more basic is a pH of 12.2 compared to a pH of 8.2?

i. After doing these calculations, if a solution has MORE H+ ions, what does that tell you about the pH? If a solution has LESS H+ ions, what does that tell you about the pH?

j. pH will become important later on because certain living things can only survive under specific pH levels. For example, acidosis can occur in a person if his/her lungs are not able to release enough CO_2 (carbon dioxide) due to a condition like asthma. If this occurs, an individual's blood pH level may drop from 7.4 to 7.35. While this change seems small, it can many negative consequences such as severe headaches and fatigue. If this individual was taken to his/her doctor's office, doctors would give him/her a bicarbonate solution to help raise the blood pH back up to 7.4. This bicarbonate would be classified as a buffer here. What is the main function of a buffer based on this scenario and based on what you have read in your textbook? How does this scenario show the effects of non-ideal pH levels in a person?

k. The carbonic acid-bicarbonate buffering system is very important in regulating pH levels of humans and also environments like the ocean. How are rising CO_2 levels in the atmosphere throwing off the pH and buffering system balance in the ocean?

l. Read through the "Scientific Skills Exercise" on pg. 54 and answer the 4 questions from the exercise below:

Chapter 4

17. Organic chemistry is the study of molecules containing carbon (particularly carbon that is bonded to hydrogen). Carbon has many unique properties itself (just as we saw with water) that enable it to form molecules that are large, complex, and diverse. We will see carbon a lot especially when we are dealing with macromolecules, photosynthesis, cellular respiration, and even ecology. The following questions address properties that make carbon unique and important.

    a. How many valence electrons does carbon have? How many bonds can carbon therefore form?

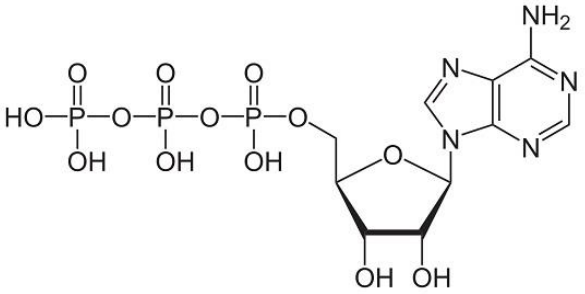
    b. What kind of bonds can carbon form with other elements? Can these bonds be single, double, triple, or all of the above? Can the molecules formed with carbon be chains, ring-shaped, branched, or all of the above?

    c. What kind of macromolecules will we see carbon in?

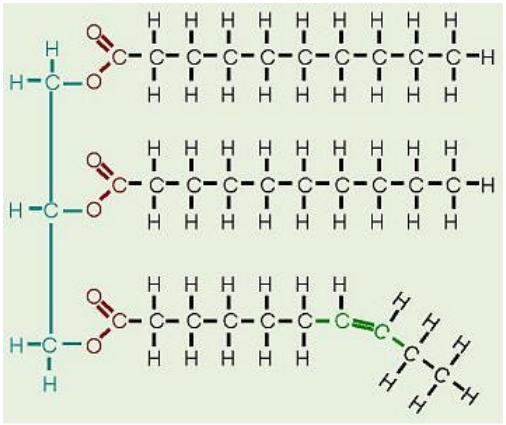
18. We will see a lot of hydrocarbons in the upcoming months. What is a hydrocarbon? Draw a hydrocarbon chain below. Are hydrocarbons hydrophilic or hydrophobic?

19. In Chapter 2, you were asked to define an isotope. Now, you are asked to know what an isomer is. Define an isomer below. Draw a molecule of glucose and fructose below and explain why they are isomers. (You MUST memorize the formula/structure of glucose so use this now to practice with it!)

20. The molecule below is ATP. You may remember the energy importance of this molecule from Honors Biology. Functional groups are groups of atoms within a carbon based molecule that have very specific properties. In this carbon based molecule, circle and label the following functional groups: *hydroxyl, amino, and phosphate*. Underneath the image, explain the unique properties of these functional groups.



21. The next chapter we will be going over together is all about macromolecules. You may remember how a lipid is one of the 4 main macromolecule categories. In the lipid below, circle and label the following functional groups: *carboxyl and methyl*. Underneath the image, explain the unique properties of these functional groups.



22. Within our macromolecule chapter, we will also be learning about proteins (another of the 4 categories). You may remember that proteins are made up of amino acids and contribute to countless important life functions. In the amino acid below, circle and label the following functional groups: *carboxyl, sulfhydryl, and amino*. Underneath the image, explain the unique properties of these functional groups.