AP Biology SUMMER ASSIGNMENT 2018

Mr. Hobein

INSTRUCTIONS

- Read Chapter 1 (BIOLOGY IN FOCUS, 2nd Ed., Campbell) to get an overview of the course and textbook
- Read Chapters 2 & 3 and complete the study guide outlined below.
- **Completion of this assignment IS NOT OPTIONAL (except for the essay portion at the end). In order to continue with the class in the fall, you must have this assignment completed and ready to turn in on the first day of the 19-20 school year.**

STUDY GUIDE FOR TEST ON CHEMISTRY OF LIFE

- To be administered during the SECOND week of the 19-20 school year

- ✓ **Organization Tip:** I would suggest completing this assignment electronically… this will allow you to add more later and/or easily fix any errors.
- ✓ **Reading Tip:** First, go to the end of each chapter and read the "Chapter Review" before you read the chapter

Chapter 2: The Chemical Context of Life

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**

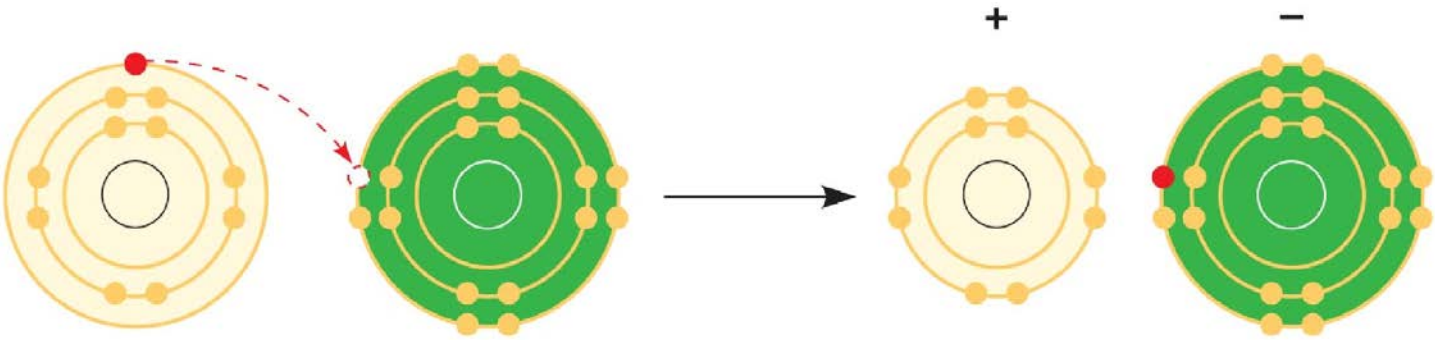
7. Which is the only subatomic particle that is directly involved in the chemical reactions between atoms?

8. What type of bond is seen in O_2? (covalent or ionic) Explain what this means.

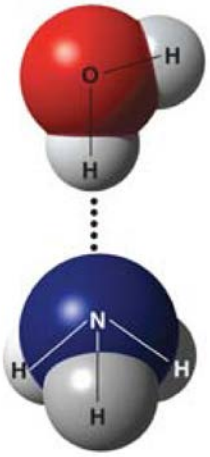
9. What is meant by *electronegativity*?

10. Explain the difference between a *nonpolar covalent bond* and a *polar covalent bond*.

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



12. What is a *hydrogen bond*? Indicate where the hydrogen bond occurs in this figure.



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

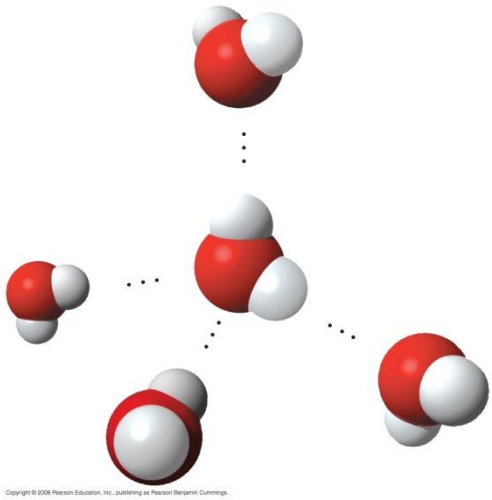
14. Here is a list of the types of bonds and interactions discussed in this section. Place them in order from the strongest to the weakest: hydrogen bonds, van der Waals interactions, covalent bonds, ionic bonds.

STRONG → WEAK

15. Write the chemical shorthand equation for photosynthesis. Label the *reactants* and the *products*.

16. Describe chemical equilibrium.

2.5 Hydrogen bonding gives water properties that help make life possible on Earth



1. Study the water molecules at the right. On the central molecule, label oxygen (O) and hydrogen (H).

2. What is a *polar molecule*? Why is water considered polar?

3. Now, add **+** and **–** signs to indicate the charged regions of *each* molecule. Then, indicate the hydrogen bonds.

4. Explain *hydrogen bonding*. How many hydrogen bonds can a single water molecule form?

Hydrogen bonding accounts for the unique properties of water. Let's look at several.

Cohesion

5. Distinguish between *cohesion* and *adhesion*.

6. What is demonstrated when you see beads of water on a waxed car hood?

7. Which property explains the ability of a water strider to walk on water?

Moderation of Temperature

8. Water has high *specific heat*. What does this mean? How does water's specific heat compare to iron's?

9. Explain how hydrogen bonding contributes to water's high specific heat.

10. Summarize how water's high specific heat contributes to the moderation of temperature. How is this property important to life?

Expansion upon Freezing

11. Ice floats! So what? Consider what would happen if ponds and other bodies of water accumulated ice at the bottom. Describe why this property of water is important.

Solvent of Life

12. Review and define these terms:
    - **solvent**
    - **solution**
    - **solute**

13. Consider coffee to which you have added sugar. Which is the solvent? The solute?

14. Explain why water is such a fine solvent.

15. Define *hydrophobic* and *hydrophilic*.

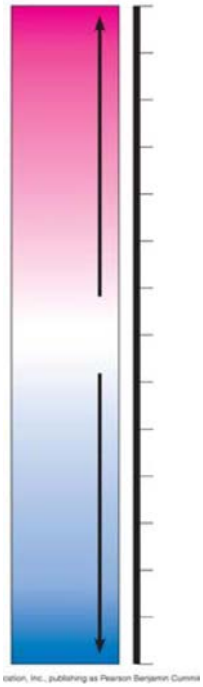
16. You already know that some materials, such as olive oil, will not dissolve in water. In fact, oil will float on top of water. Explain this property in terms of hydrogen bonding.

Concept 2.6 Acidic and basic conditions affect living organisms

1. What two ions form when water dissociates?

(You should have answered "hydronium (H_3O+) and hydroxide ions ($OH–$)" in the preceding question. However, by convention, we will represent the hydronium ion as H+.)

2. Water, which is neutral with a pH of 7, has an equal number of H+ and OH– ions. Now, define
   - **acid**
   - **base**



3. On the pH chart, label pH 0–14. Label *neutral, acid, base*. Indicate the locations of pure water, urine, gastric juice, and bleach.

4. Even a slight change in pH can be harmful! How do *buffers* moderate pH change?

5. Exercise will result in the production of CO_2, which will acidify the blood. Explain the buffering system that minimizes blood pH changes.

Chapter 3: Carbon and the Molecular Diversity of Life

Concept 3.1 Carbon atoms can form diverse molecules by bonding to four other atoms

1. Make an electron distribution diagram of carbon. It is essential that you know the answers to these questions:

   a. How many valence electrons does carbon have?

b. How many bonds can carbon form?

c. What type of bonds does it form with other elements?

2. What is an isomer and what is an example of isomers?

3. There are seven functional groups. Complete the following chart which includes 6 of them.

Functional Group	**Structure**	**Properties:** hydrophobic or hydrophillic? form Hydrogen bonds? uses? What macromolecules are they found on? (This last question will be easier to answer after you do the 3B notes.)
Hydroxyl		
Carboxyl		
Amino		
Phosphate		
Sulfhydryl		

Methyl		

Concept 3.2 Macromolecules are polymers, built from monomers.

1. What is a polymer? A monomer?

2. Monomers are connected in what type of reaction? What occurs in this reaction?

3. Large molecules (polymers) are converted (broken down) to monomers in what type of reaction?

4. The root words of *hydrolysis* will be used many times to form other words you will learn this year. What does each root word mean?

- **hydro–**

- **lysis—**

Concept 3.3 Carbohydrates serve as fuel and building material

1. Let's look at carbohydrates, which include sugars and starches. First, what are the monomers of all carbohydrates? What is the name of the link that binds the monomers together?

2. Most monosaccharides are some multiple of (CH_2O). For example, ribose is a 5-carbon sugar with the formula $C_5H_{10}O_5$. It is a pentose sugar. (From the root *penta–,* meaning 5.) What is the formula of a hexose sugar?

3. There are two main functions of *polysaccharides*. Identify them and give examples.

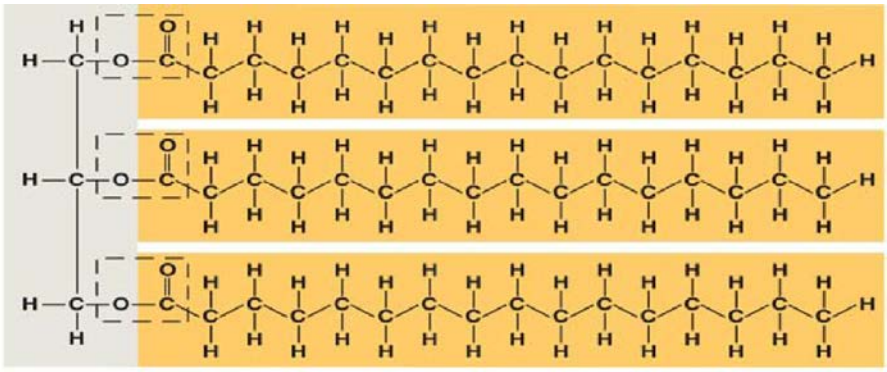
Function of Polysaccharide	**Examples**

4. Why can you not digest cellulose? What organisms can?

Concept 3.4 Lipids are a diverse group of hydrophobic molecules

1. Lipids include fats, waxes, oils, phospholipids, and steroids. What characteristic do all lipids share?

2. What are the building blocks of *fats*? Label them on this figure.



3. If a fat is composed of 3 fatty acids and 1 glycerol molecule, how many water molecules will be removed to form it? Again, what is this process called?

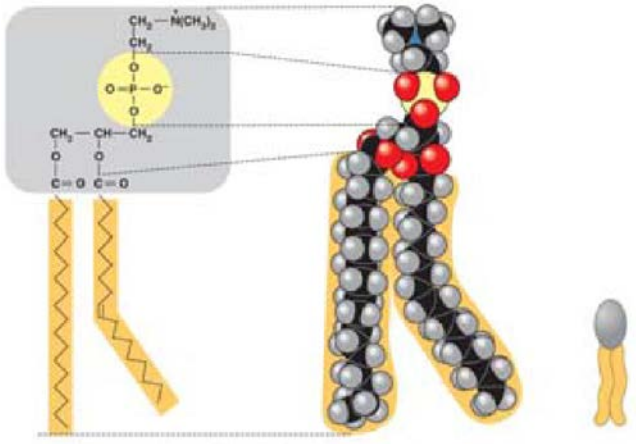
4. On the figure above, label the ester linkages.
5. Define and name two saturated fats.

6. Define and name two unsaturated fats.

7. Why are many unsaturated fats liquid at room temperature?

8. List two important functions of lipids.

9. Here is a figure that shows the structure of a phospholipid. Label the sketch to show the phosphate *group*, the *glycerol*, and the *fatty acid chains*. Also indicate the region that is *hydrophobic* and the region that is *hydrophilic*.



10. Why is the "tail" hydrophobic?

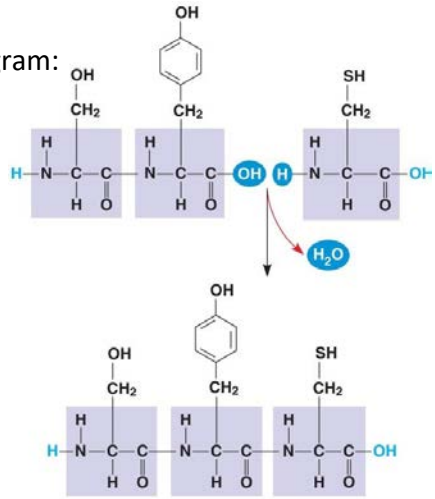
11. Which of the two fatty acid chains in the figure with question 31 is unsaturated? Label it. How do you know it is unsaturated?

12. What do all steroids have in common and what are three examples of steroids?

Concept 3.5 Proteins have many structures, resulting in a wide range of functions

1. The monomers of proteins are *amino acids*. Sketch an amino acid in the box (like the sketch on the bottom of p. 56 in your text. Label the *alpha* or *central carbon*, *amino group*, *carboxyl group*, and *R group*.

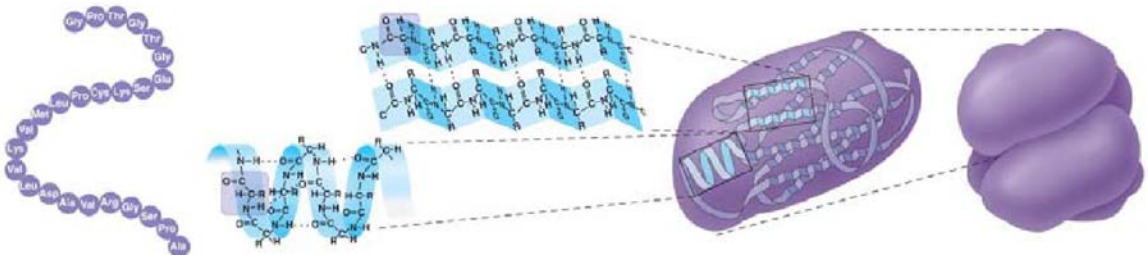
2. Define then label these terms on the diagram:
   - **dipeptide**
   - **polypeptide**
   - **peptide bond**



3. There are four levels of protein structure. Refer to Figure 3.22, and summarize each level in the following table.

Level of Protein Structure	Explanation
Primary	
Secondary (Alpha helix or Beta pleated sheet)	
Tertiary	
Quaternary	

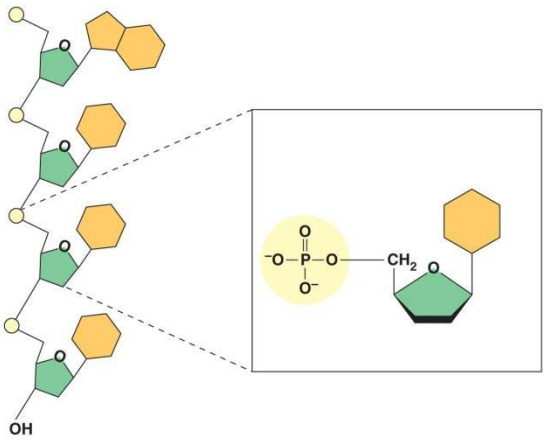
4. Label each of the levels of protein structure on this figure.



5. Besides mutation, which changes the primary structure of a protein, protein structure can be changed by denaturation. Define *denaturation*, and give at least three ways a protein may become denatured.

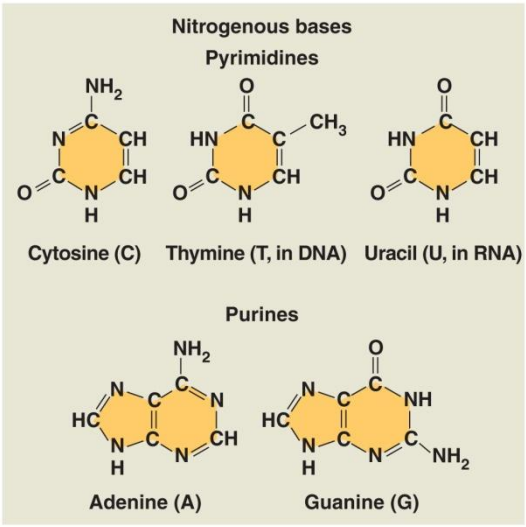
Concept 3.6 Nucleic acids store and transmit hereditary information

1. What are the three components of a nucleotide?. Label each on the figure to the right.



2. Notice that there are five nitrogen bases. Which four are found in DNA?

3. Which four are found in RNA?



(c) Nucleoside components: nitrogenous bases

4. What is the function of DNA? Of RNA?

5. What type of bond holds the nitrogenous bases together in the double helix of DNA?

Resources:

Biochemistry: Unit 1	
Chapter	**Videos**
Chemical Context of Life	
Water	Crash Course Water
Carbon and the Molecular Diversity of Life	Crash Course Carbon
Macromolecules	Crash Course Macromolecules

ESSAY

The following essay question will be on the Chemistry of Life Test, WORD FOR WORD. **This question is OPTIONAL as far as this assignment is concerned**. If you want to write a response to this question I will be happy to look them over ONLY if it is turned in on our FIRST class of the new year.

ESSAY QUESTION:

Define/discuss the following properties of water and give an example of how each property is related to the functioning of living organisms:

1. Surface tension/cohesion
2. Adhesion
3. Specific heat
4. Vaporization
5. Freezing.

Essay Resources:

https://courses.lumenlearning.com/boundless-biology/chapter/water/