

AP Biology Summer Assignment

AP Biology is designed to be a second-year biology course. It is assumed that prior to taking AP Biology you have successfully completed both Honors Biology and Honors Chemistry with high A averages. Due to the intense nature of the course curriculum, and the limited amount of time prior to the AP exam for covering the material, it is expected that you have a strong grasp of Honors Biology and Honors Chemistry topics-hence, the importance of this summer assignment.

There will be a quiz based upon the summer assignment on the second day of class. AP Biology requires significant preparation and study on the part of the student. Make sure that your work skills are honed for the coming year. Expect to spend some time on the class every day at home.

If you would like to reach out to me over the summer, feel free to contact me by email at llewis@parrottacademy.org.

I look forward to a year full of AP Biology FUN with you!

Have a wonderful summer,

Mrs. Lewis

Summer Assignment Directions:

1. Go to the Bozeman Science website (<https://www.bozemanscience.com/biology-main-page>) and watch the following videos. Take notes as needed, and complete the attached worksheet to turn in (Biological Molecules Video Worksheet)
 - Water & Life
 - Water – A Polar Molecule
 - Biological Molecules
 - Molecules of Life
2. Complete the attached POGIL, Biochemistry Basics to turn in.
3. Study the material covered in the above directions in preparation for the quiz on the second day of class.

AP Biology 042 – Biological Molecules

Video Review Sheet

www.bozemanscience.com/042-biological-molecules

1. What are the four categories of macromolecules?
2. What is a monomer?
3. Lipids are unique because they don't have a single type of monomer. Name two reasons why lipids are important.
4. Lipids are generally polar molecules. T/F circle one
5. Nucleic acid monomers are _____ and are made up of _____
6. What are the functions of nucleic acids?
7. Protein monomers are:
8. What differentiates one amino acid from another?
9. Carbohydrate monomers are
10. The significance of "directionality" of the monomers in a polymer is that when you put the monomers together in a certain sequence/order they have
 - a. The process of "putting monomers together" is called
 - b. What is lost during the process of #11?
 - c. What kind of bond is formed generally? Specifically between amino acids of a protein?
 - d. What must be added to break the bonds?
 - e. What is the name of that process?
11. Concerning **Nucleic Acids**:
 - a. What are the two examples of nucleic acids he gave? (btw ATP is also an example)
 - b. What is a nucleotide and what are its three parts?
 - c. What are differences between DNA and RNA?
 - d. What are the four nucleotides in DNA? RNA?
 - e. When you see 3' and 5', this is referring to the nucleic acid's directionality and specifically to the carbons found in the

f. What makes DNA antiparallel?

12. Concerning **Proteins**:

- a. The protein monomer is:
- b. How many amino acids are there?
- c. Draw and label a basic amino acid in the box to the right.



- d. What part of the amino acid differentiates it from another?
- e. What is the directionality of a protein?
- f. What is the significance of the directionality in protein digestion?

13. Concerning **Lipids**:

- a. List the different types of lipids (4):
- b. What is the similar structure between the four?
- c. What is significant about hydrocarbons found in lipids? (2):
- d. What is unique about phospholipids?
- e. What does amphipathic mean?
- f. What is the difference between saturated and unsaturated fatty acids?
- g. Why do unsaturated fats bend?
- h. Why is margarine a solid though it originates from plants? (btw, butter is *solid* at room temperatures)

14. Concerning Carbohydrates:

- a. Carbohydrates give us: (2)
- b. Carbohydrate monomers are
- c. What are the two types of glucose molecules indicated?
- d. What determines directionality in carbohydrates?

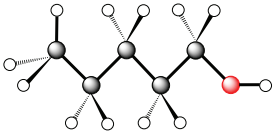
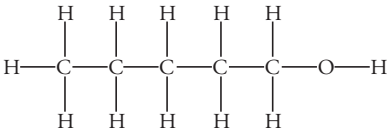
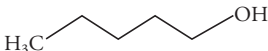
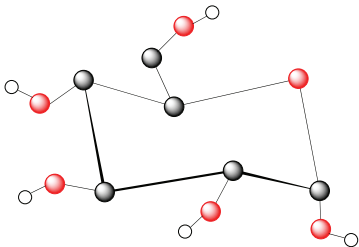
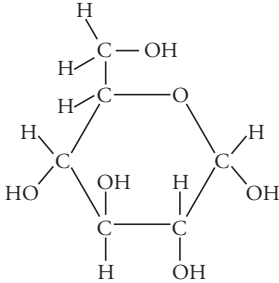
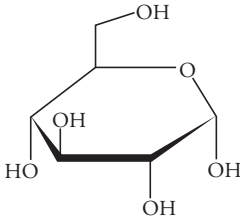
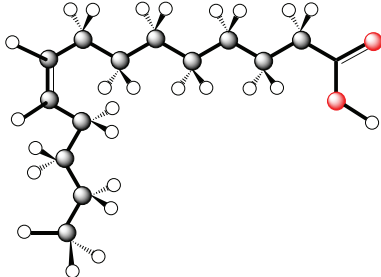
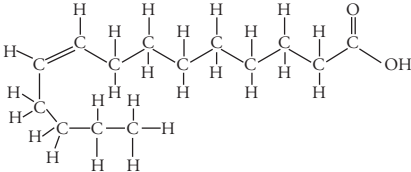
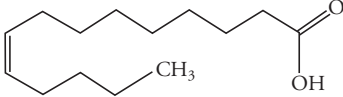
Biochemistry Basics

What concepts from chemistry are helpful in studying biology?

Why?

Typically chemistry is a prerequisite course for advanced biology courses. This is because everything in your body, everything in a plant, everything in a virus, etc. is made of atoms. The structures and properties of the molecules in an organism determine the features and properties of the organism. Which molecules are polar, which are nonpolar? Which molecules have acidic properties, which have basic properties? A quick review of these concepts at the beginning of your advanced biology course will help you to understand the molecular basis for life.

Model 1 – Molecular Drawings

<p>Ball-and-stick model of 1-pentanol</p> 	<p>Lewis structure of 1-pentanol</p> 	<p>Line drawing of 1-pentanol</p> 
<p>Ball-and-stick model of glucose</p> 	<p>Lewis structure of glucose</p> 	<p>Line drawing of glucose</p> 
<p>Ball-and-stick model of unsaturated fatty acid</p> 	<p>Lewis structure of unsaturated fatty acid</p> 	<p>Line drawing of unsaturated fatty acid</p> 

1. Name the three molecules that are illustrated in Model 1.
2. Name the three types of drawings that are used to illustrate the molecules in Model 1.

3. How many bonds are typically formed by each of the following atoms:

Carbon

Hydrogen

Oxygen

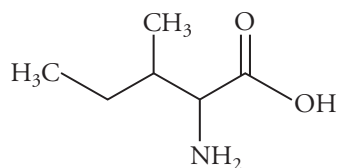
4. Which types of drawings in Model 1 provide more accurate images of the shape of a molecule? Justify your reasoning.

5. Refer to Model 1.

a. Symbols or atoms of what element(s) are missing from the line drawings?

b. In reading a line drawing, how do you know where atoms of these elements are in the structure if they are missing from the drawing?

6. Locate the carbon and hydrogen atoms in the line drawing of isoleucine shown below and draw them in as if the drawing were a Lewis structure.



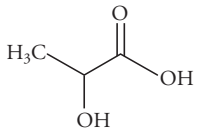
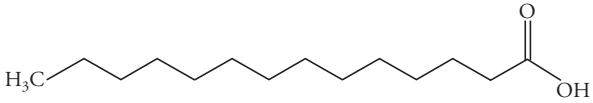
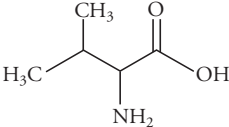
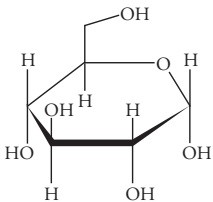
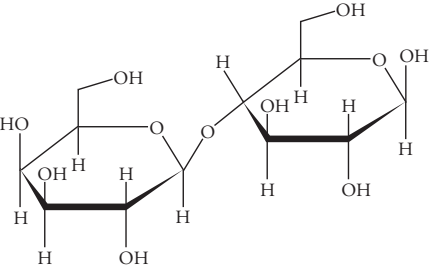
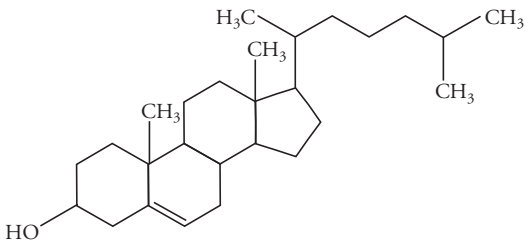
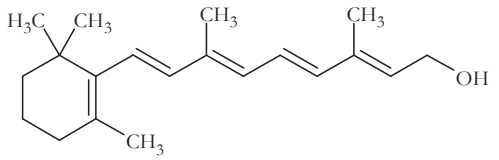
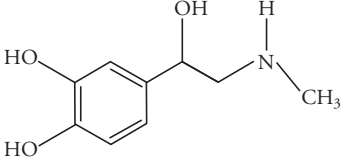
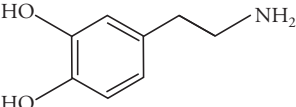
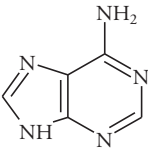
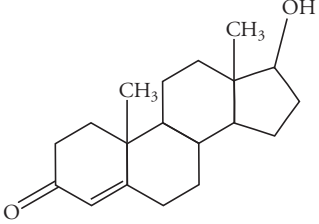
Isoleucine

7. Isopropyl alcohol is a three-carbon molecule with an –OH group attached to the middle carbon atom. Draw this molecule using all three types of drawings.

8. If you were asked to write the chemical formula for one of the compounds in Model 1, which type of the drawing would be the easiest to use? Justify your reasoning.

9. What is the advantage to a scientist in using a line drawing rather than a ball-and-stick model or Lewis structure?

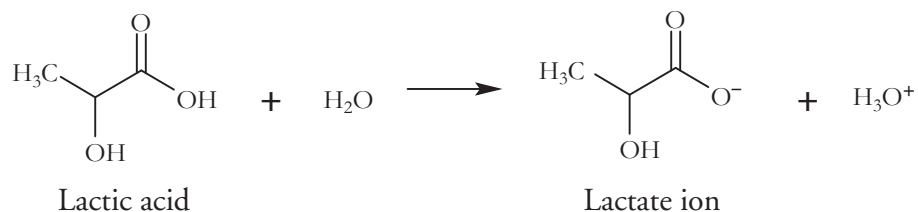
Model 2 – Properties of Biological Molecules

Polar Molecules (hydrophilic)	Nonpolar Molecules (hydrophobic)
<p>Acidic</p>  <p>Lactic acid</p>	<p>Acidic</p>  <p>Fatty acid</p>
<p>Neutral</p>  <p>Valine (amino acid)</p>  <p>Glucose</p>  <p>Lactose</p>	<p>Neutral</p>  <p>Cholesterol</p>  <p>Vitamin A</p>
<p>Basic</p>  <p>Adrenaline</p>  <p>Dopamine</p>  <p>Adenine</p>	 <p>Testosterone</p>

10. Consider the polar molecules in Model 2.
- In general, the presence of atoms of what element(s) makes a molecule polar?
 - What property do atoms of these elements have that helps make the molecules they are in polar?
 - Can nonpolar molecules also have atoms of these elements? If yes, what distinguishes a nonpolar molecule from a polar molecule?
11. In chemistry there is a saying “like dissolves like,” which means things will mix with or dissolve into each other best when their polarities are similar.
- Is water polar or nonpolar?
 - Is oil polar or nonpolar?
 - Which of the substances in Model 2 would dissolve well in water? Justify your reasoning.
 - Which of the substances in Model 2 are more likely to dissolve well in oil? Justify your reasoning.
 - Which class of substances in Model 2, polar or nonpolar, is more likely to be found in high concentrations in the bloodstream of a vertebrate? Justify your reasoning.
12. Refer to Model 2.
- What is another term for a polar molecule?
 - What is another term for a nonpolar molecule?
 - Give the literal translation for the terms you gave in parts *a* and *b* above.

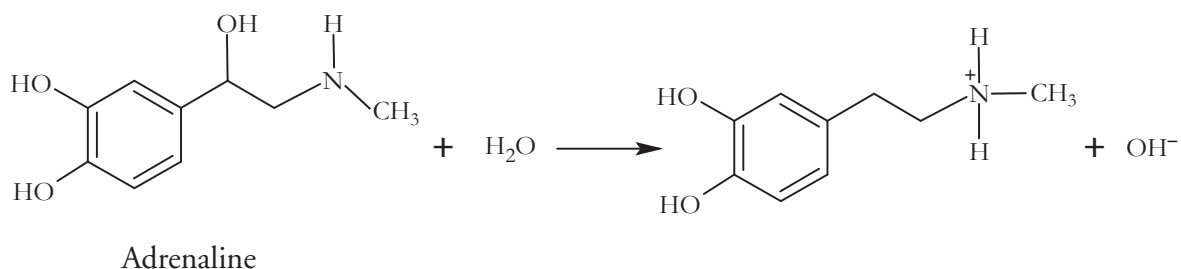
13. Functional groups are key groups of atoms in biological molecules. Describe the carboxyl functional group that both acidic molecules in Model 2 have in common.

14. Recall the definition of an acid that you learned in chemistry. Explain how the reaction below illustrates the acidic properties of lactic acid.



15. Describe the functional group, called an amine group, that the basic molecules in Model 2 all have in common?

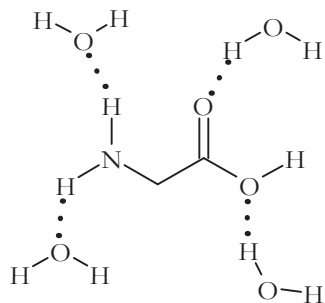
16. Recall the definition of a base that you learned in chemistry. Explain how the reaction below illustrates the basic properties of adrenaline.



17. Predict the approximate pH (pH = 7, pH > 7 or pH < 7) of fairly concentrated aqueous solutions of the following compounds from Model 2.

Lactic acid	_____	Dopamine	_____
Amino acid	_____	Lactose	_____

18. In chemistry you learned that covalent bonds are one type of intramolecular bond. They occur between nonmetal atoms in a molecule. You may have also learned about a type of intermolecular bond called a hydrogen bond. Hydrogen bonds are weak attractive forces between polar molecules containing the very polar bonds such as H-O, H-N or H-F.

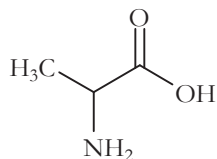
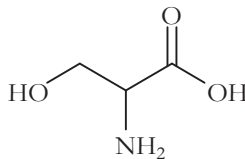


- Label at least two covalent bonds in the diagram above.
 - Label at least one hydrogen bond in the diagram above.
19. Which of the molecules in Model 2 would form hydrogen bonds with itself (that is, other molecules of the same type) or with water molecules if in a solution?

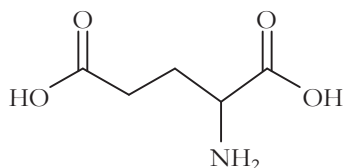
Extension Questions

20. Although amino acids have “acid” in their name, some are acidic in water solutions, some are basic, and others are neutral. Propose an explanation for this observation based on the structures and descriptions of the amino acids below.

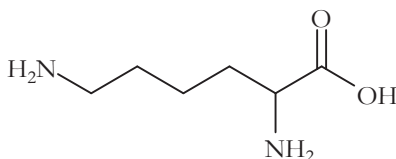
Neutral amino acids



Acidic amino acid

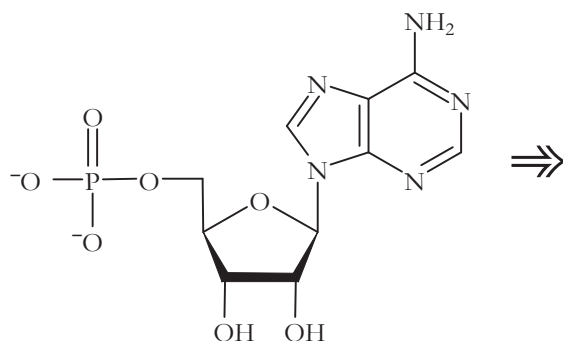


Basic amino acid



21. The structure shown below is a line drawing of noncyclic AMP, an important messenger molecule in molecular communication systems.

a. Draw the missing carbon and hydrogen atoms on the molecule.



b. Write the chemical formula for a molecule of noncyclic AMP.

22. The phosphate functional group in the noncyclic AMP molecule of Question 21 contains “acidic hydrogens.”
- a.* Explain what this phrase means.

b. Draw the noncyclic AMP molecule after it has dissolved in water.