

- **PHYSICALLY PRINT OUT** this PDF and **HANDWRITE** (with a black or blue pen) your answers directly on this PDF. Typed or digitally-written work is **not** accepted. Do **not** answer questions on separate paper.
- **Importantly, study guides are NOT GROUP PROJECTS!!!** You, and you alone, are to answer the questions as you **read** your assigned textbook. You are **not** to share answers with other students. You are **not** to copy any answers from any other source, including the internet.
- **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** AP essay readers and I will skip grading anything that cannot be easily read so start perfecting your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.
- **SCAN physical documents in color and with good resolution. Then, upload your final work as PDFs to Archie.** Avoid uploading dark, shaded, washed-out, sideways, or upside-down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.
- **READ FOR UNDERSTANDING and not merely to complete an assignment.** *First*, read a section quickly to get an overview of the topic covered. Then, read it a **second** time slowly, paraphrasing each paragraph **out loud** and analyzing every figure. Finally, read it a **third** time as you answer the study guide questions if assigned and start building your memory. Try to write answers out in your own words, when possible, and try to purposefully and accurately use all new terminology introduced.

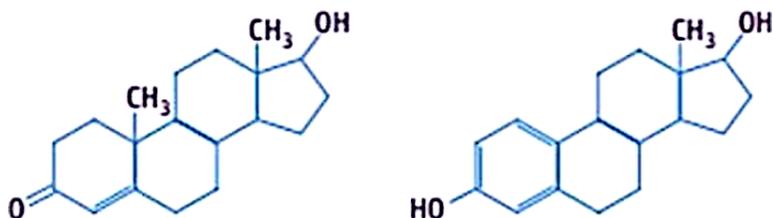
1. a. Remember, even small **changes in a molecule's structure/shape can change its function!** In what **two ways** do **chemical groups contribute to the function of carbon-based, organic molecules?**
 - i.
 - ii.
 - b. When are chemical groups referred to as **functional groups**?
-
2. a. Which six of the seven **chemical groups** introduced in this chapter that are most important in biological processes are **chemically reactive**?

 - b. Which five **chemical groups** of the six reactive chemical groups listed above are **hydrophilic**, thereby making the hydrocarbon they are attached to more soluble in water given that hydrocarbons are non-polar molecules and hydrophobic on their own. (*Note that those that are hydrophilic include atoms bonded together through polar covalent bonds, resulting in atoms that gain partial positive or partial negative charges*).

 - c. Which **chemical group is nonreactive** (meaning that it does **not** partake in any chemical reactions)?

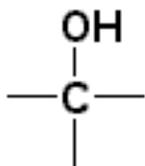
 - d. Based on what you learned in Chapter 2 about covalent bonds and molecular polarity, **WHY** is the **methyl group nonpolar** compared to the other chemical groups you listed in question #2.b.?

3. **Hormones** are molecules that act like **chemical messengers** in the body. After being made and secreted by tissue cells in one part of the body, they travel to other parts of the body where they help control and coordinate how these target cells, tissues, and organs do their work. Despite how similar estradiol (right) and testosterone (left), male and female sex hormones, respectively, are, they have very different effects in the vertebrate body. Circle **and** name the **chemical groups** attached to these sex hormones' carbon skeletons.



4. Study Figure 4.9. Name each **Chemical Group** drawn. State the **name of the group**, the **generic name of compounds** that have these chemical groups, and list any **properties** these groups contribute to compounds.

a.

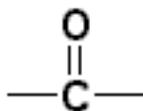


Chemical Group:

Compound Name:

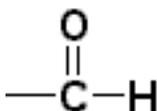
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b.



Chemical Group:

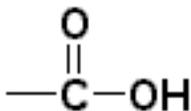
Compound Name:



Compound Name:

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c.

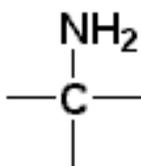


Chemical Group:

Compound Name:

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d.



Chemical Group:

Compound Name:

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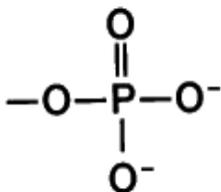
e.



Chemical Group:

Compound Name:

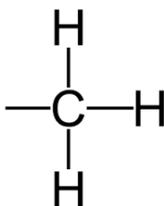
f.



Chemical Group:

Compound Name:

g.

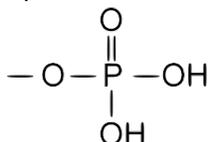


Chemical Group:

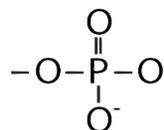
Compound Name:

5. Now, based on what you learned, three of these seven chemical groups **ionize in water at the pH found in cells**, either losing proton to water or gaining a proton from water, and thus becoming either negative or positive in overall charge. **Phosphate, for example, exists in ionized form in many biological solutions.**

This is phosphate in **nonionized** form:



This is phosphate in **ionized** form:



Besides the phosphate shown above, which **functional group act as an acid and which one acts as a base?** (Meaning, which of the functional groups have an atom that can gain a proton and become fully positively charged or lose a proton and become fully negatively charged?)

- a. Name of other **Functional Group which acts as an Acid** = _____

Drawing of **nonionized** form:

Drawing of **ionized** form:

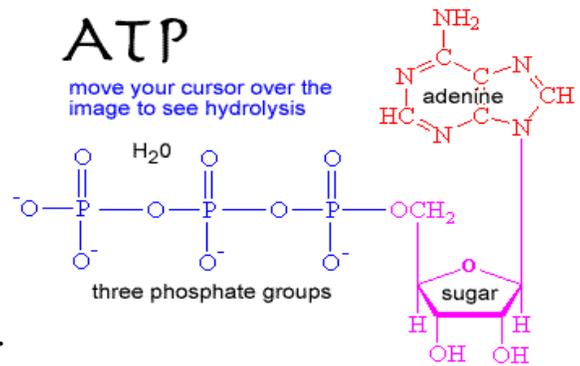
- b. Name of **Functional Group which acts as a Base** = _____

Drawing of **nonionized** form:

Drawing of **ionized** form:

6. Below, you'll find the structural formula for **ATP**.

- a. What does **ATP** stand for?
- b. Study the chemical reaction that takes place when **ATP reacts with water** (in the presence of a biological catalyst, not shown). What happens during this reaction that makes ATP so important to living organisms?



Before continuing, study all that you read and learned about in Ch.4.3.

7. Recall that proteins are made up of polypeptides, which are made up of smaller molecular units called amino acids. Look at figure 4.9. **What does the term “amino acid” signify about the structure of such a molecule?** (Check your answer by going to the [Ch.4.3 Concept Check Question](#) answer for Question 1.a in Appendix A of your textbook)
8. a. Suppose you took the amino acid cysteine (see figure 4.9’s sulfhydryl group example) and removed the amino group, replacing it with a carboxyl group instead. Draw what this molecule looks like before and after.
- Before =** **After =**
- b. How would this specifically change the chemical properties of this cysteine molecule?
- c. Is the central carbon asymmetric or symmetric before and also after the change? (Check your answers to a-c by going to the [Ch.4.3 Concept Check Question](#) answer for Question 3 in Appendix A of your textbook)
9. Having hopefully now memorize the chemical groups highlighted in this section, let’s test your memory and see if you can identify the chemical groups being discussed.
- | | |
|--|---|
| a. $-NH_2 =$ | b. Forms cross-links to stabilize protein shape = |
| c. Key component of ATP = | d. Can interfere with gene expression = |
| e. Is(are) polar = | |
| f. Determines the two groups of sugars = | |
| g. Has acidic properties = | h. Has basic properties = |
10. Proceed to the **TEST YOUR UNDERSTANDING** section at the end of the chapter. **Study all chapter sections first!** Then, do your best to answer these questions from memory before going back to look up the concepts in the relevant section of the book in order to review material you did not fully grasp yet. *To check select answers, go to the Ch.4 Test Your Understanding section in Appendix A of your textbook.*
1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____
8. a.
- b.
- 9.