NAME (print) Answer Key

CHEM 243 - Organic Chemistry I – Fall 2021 **Bonus Points_____ (15 max)**

"Worksheet Zero" (Review): Due Wednesday, September 8 in class (I will not accept late worksheets). You can earn up to 15 Bonus Points that will be used to replace missed worksheets and/or low worksheet grades. You must attempt the entire worksheet to receive full credit for your work.

"Worksheet Zero" is a review of basic concepts from CHEM 141-142 that will be relevant in organic chemistry. You may work together, but each student must turn in their own work. If you have trouble answering these questions it is imperative that you get help from me or the CHEM 243 Peer Leaders.

To complete this worksheet by September 8, you can:

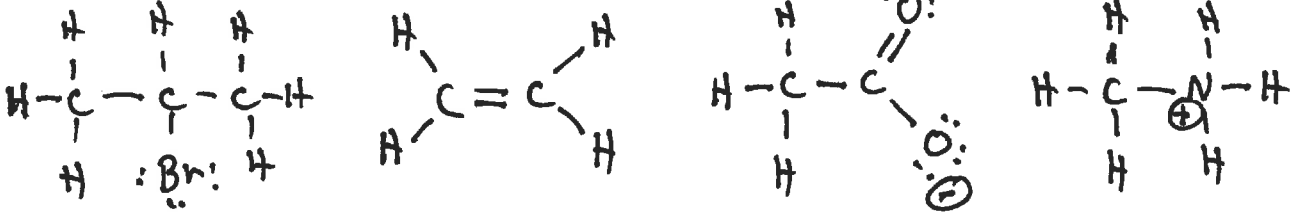
- Study lecture videos 1-1 to 1-3 on the course web page (http://webhost.bridgew.edu/ebrush/CH343%20audio.htm)
- Use any other resource available to you (i.e., your CHEM 141-142 notes)
- Work with a group of students during class time
- Working on your own outside of class
- Get help from the course instructor, Peer Leaders, and other students in the class

PART I. Read the Complete Syllabus. By initialing here (*) I confirm that I have read the complete class syllabus and understand the expectations for this course.

PART II. Review Questions.

(1) Lewis Structures and Lone Pairs. Review the process for drawing Lewis Structures, and draw the best Lewis Structure for each of the following organic compounds. Include lone pairs for all halogen, oxygen and nitrogen atoms.

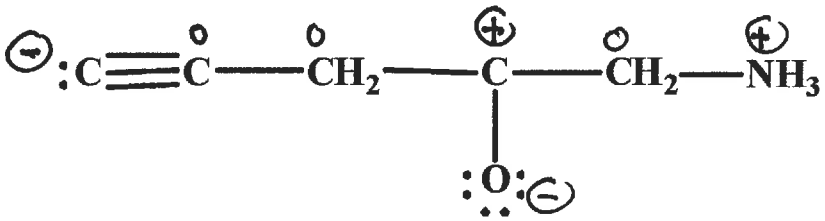
$CH_3CHBrCH_3$ CH_2CH_2 $[CH_3CO_2]^{-1}$ $[CH_3NH_3]^{+1}$



(2) Formal Charge of an atom. You should review the concept of "formal charge" on the atoms in a molecule, and understand how formal charge relates to the molecular charge.

(a) For each Lewis structure that you drew above, assign Formal Charges to specific atoms.

(b) Assign the proper Formal Charge to each C, N, and O atom in the structure drawn below:



(3) Covalent Bonds, Hybridization and Molecular Geometry. Review the definition of sigma and pi covalent bonds, atomic orbital hybridization, and how hybridization is connected to molecular geometry.

(a) What do we mean by "sigma" and "pi" covalent bonds?

sigma ≡ the bonding electrons are found inbetween the two atoms.

pi ≡ the bonding electrons are above & below the sigma bond.

(b) Write the geometry for each atom with the given hybridization (tetrahedral, bent, linear, trigonal pyramid, trigonal planar):

C with sp hybridization linear

C with sp2 hybridization trigonal planar

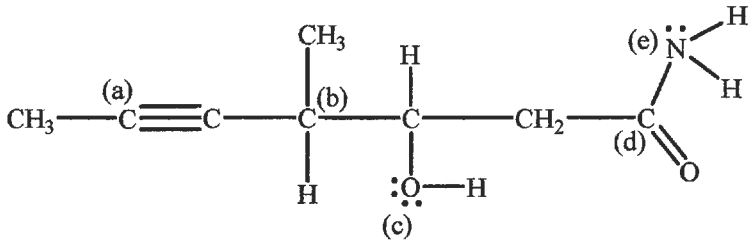
C with sp3 hybridization tetrahedral

:O: with sp2 hybridization linear

:O: with sp3 hybridization bent

:N with sp3 hybridization trigonal pyramid

(c) Complete the following table by indicating the molecular geometry (tetrahedral, bent, linear, trigonal pyramid, trigonal planar) and hybridization (sp, sp2, sp3) of each labeled atom in the molecule below.



atom	hybridization	Molecular geometry
(a) C	SP	linear
(b) C	SP3	tetrahedral
(c) O	SP3	bent
(d) C	SP2	trigonal planar
(e) N	SP3	trigonal pyramid

(d) What is the total number of **pi covalent bonds** in the molecule above? 3

(e) Write the molecular formula for this molecule (ex., $C_wH_xN_yO_z$): $C_8H_{13}NO_2$

(f) What is the molecular mass of this molecule (4 significant figures): 155.2 g/mole

(g) If you had 0.673 g, how many moles would you have? 0.00434 or 4.34×10^{-3} mole

Show your work below and use correct significant figures:

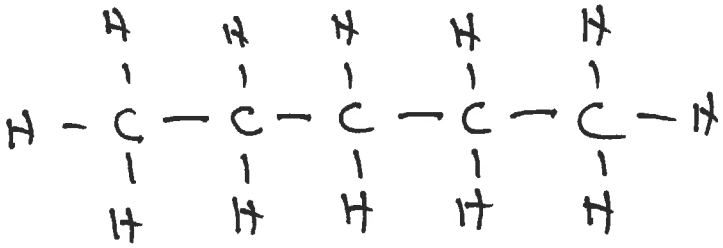
$$0.673\,g \times \frac{1\,mole}{155.2\,g} = 0.00434\,mole$$

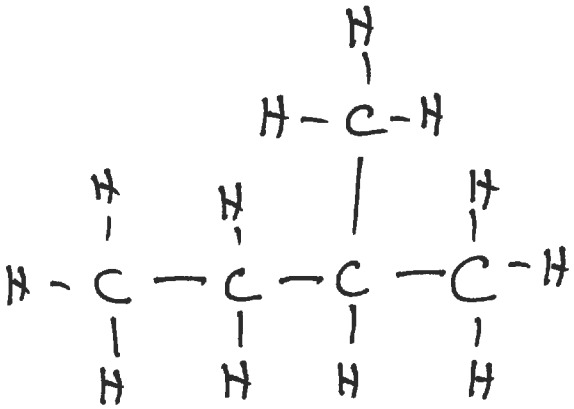
(4) Relationship between Covalent Bonds, Lone Pairs, Geometry and Hybridization for an Atom. Based on the *incomplete* information given in each row of this table, complete the empty boxes for each atom. **This is NOT related to the molecule above!**

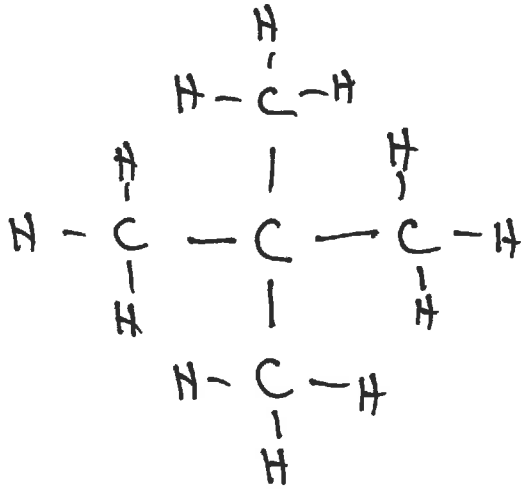
Atom	Sigma Covalent Bonds	Pi Covalent Bonds	Lone Pairs	Molecular Geometry	Hybridization
Carbon	**4**	**0**	**0**	tetrahedral	sp3
Carbon	3	1	**0**	**trigonal planar**	sp2
Carbon	2	**2**	**0**	linear	**sp**
Oxygen	**2**	**0**	**2**	bent	sp3
Nitrogen	**3**	**0**	**1**	trigonal pyramid	sp3

(5) Drawing Simple Organic Chemical Structures.

(a) There are three possible structures of organic compounds with the formula C_5H_{12}. Try drawing these three structures.







(b) Give a definition that describes the relationship between these three compounds? HINT: See video 1-3.

Constitutional Isomers — compounds with the same formula but different connectivity.