Names of all students (please print) _____

_____

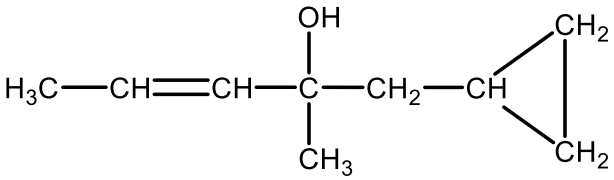
CHEM 243 Organic Chemistry I **Points_____ (10 max)**

Worksheet #2: September 11, 2024. Complete the following worksheet by collaborating with a group of 3-4 students. You can use a text book or your lecture video notes. You must work together, with the names of all students included on **ONE** sheet and turned in for a group grade.

You can join any table in room 477 or 481 (3-4 students per table)

(1) Characterizing sp3 carbons.

(a) In the molecule drawn at the right, indicate the **total number** of 1° (primary), 2° (secondary) and 3° (tertiary) carbons.
NOTE: The 1°, 2°, 3° designations only apply to sp3 carbons.



Total 1° carbons _____ Total 2° carbons _____ Total 3° carbons _____

(b) The C–OH (alcohol) carbon can be designated as: **1°** **2°** **3°** (CIRCLE)

(c) For the structure drawn above: (i) How many pi bonds are there? _____

(ii) How many rings are there? _____

(iii) Based on your answers to (i) & (ii), what is the Hydrogen Deficiency? _____
(HINT: It is <u>not</u> necessary to calculate the HD)

(2) Hydrogen Deficiency. An unknown has the formula C_4H_8.

(a) Calculate the Hydrogen Deficiency (HD): _____

(b) Based on the **HD and Formula**, CIRCLE all possible functional groups from the list below:

alkene	**carbonyl**	**alkyne**	**alcohol**	**ether**	**cycloalkyl**
(C=C double bond)	(C=O double bond)	(C≡C triple bond)	(R-OH)	(R-O-R)	(C atoms form a ring)

(3) Drawing Structures. An unknown compound has a formula $C_4H_{10}O$.

(a) Calculate the Hydrogen Deficiency (HD): _____

(b) Based on the **HD and Formula**, CIRCLE all possible functional groups from the list below:

alkene	**carbonyl**	**alkyne**	**alcohol**	**ether**	**cycloalkyl**
(C=C double bond)	(C=O double bond)	(C≡C triple bond)	(R-OH)	(R-O-R)	(C atoms form a ring)

(c) The unknown has one 3° carbon, three 1° carbons, and the oxygen is bonded to a 1° carbon. In the space at the right, draw an accurate structure that fits these data (bond-line or zig-zag).

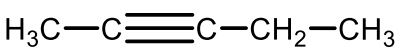
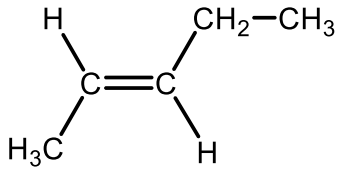
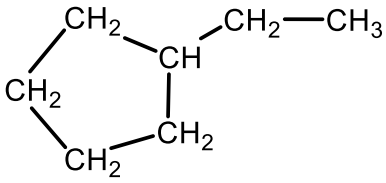
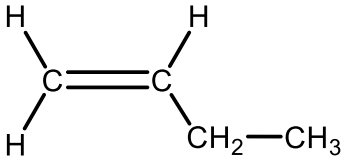
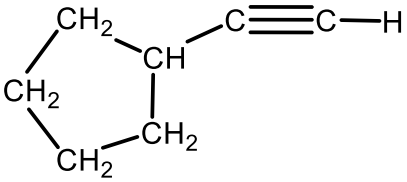
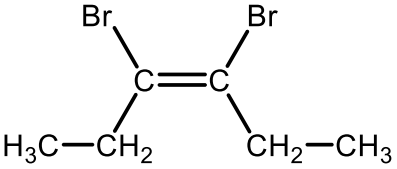
(4) Structures of Alkenes and Alkynes. Answer the following questions as indicated:

(a) Based on the formulas given below, indicated if the compound might be an alkane, alkene or alkyne:

C_5H_8 _____ **C_7H_{16} _____** **C_6H_{12} _____** **C_3H_4 _____**

(b) Which of the following terms best describes **each** structure drawn below (only one term per structure):

cis alkene (cis) **trans alkene (trans)** **internal alkyne (int)** **terminal alkyne (ter)** **none of these (N)**

 answer _____	 answer _____	 answer _____
 answer _____	 answer _____	 answer _____

(5) Basic Calculations. The purpose of these calculations is to help prepare you for the laboratory. The compound you drew in problem #3 above, **$C_4H_{10}O$, has a molecular mass of 74.12 g/mole.** Answer the following questions using **correct significant figures and units**.

(a) If you had 0.1951 moles of this compound, how many grams would you have? Answer: _____

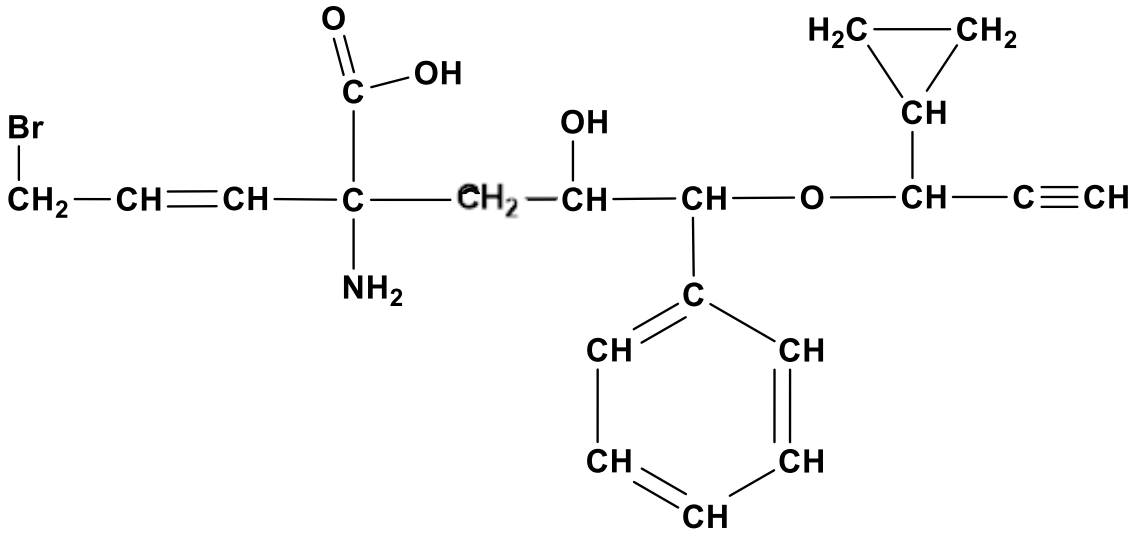
(b) Assuming this compound is a liquid, based on your answer to (a),
how many mL would you have if the density is 0.914 g/mL? Answer: _____

Use this space for your calculations:

(6) Functional Groups.

(a) In the molecule drawn below, label each functional group using the (a – j) letter codes given. Some codes may be used once, others not at all.

(a) alkene
(b) internal alkyne
(c) terminal alkyne
(d) cycloalkyl ring
(e) benzene ring
(f) halogen
(g) alcohol
(h) ether
(i) carboxylic acid
(j) amine



(b) For the structure drawn above:

(i) How many pi bonds are there? _____

(ii) How many rings are there? _____

(iii) Based on your answers to (i) & (ii), what is the Hydrogen Deficiency? _____
(HINT: It is not necessary to calculate the HD)