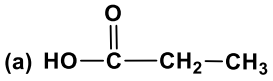
Names of all students (please print) _____

_____

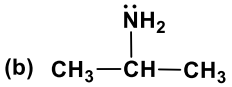
CHEM 243 Organic Chemistry I **Points_____ (10 max)**

Worksheet #4: September 13, 2021. 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.

(1) Acids and Bases. For each acid draw the conjugate base, and for each base draw the conjugate acid. **Be sure to label atoms with their appropriate formal charge!**

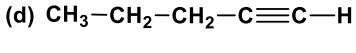


conjugate base:



conjugate acid:

(c) HSO_4^- conjugate acid:
(base)



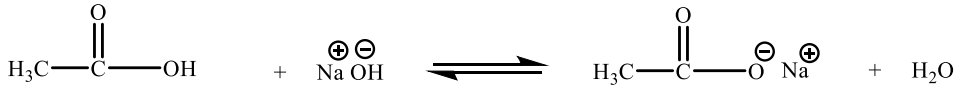
conjugate base:

(2) Acids, Bases, Conjugate Acids, Conjugate Bases, and pKa's. What follows is a series of acid-base reactions. Although I expect that you should be able to identify the more common acids and bases, in some cases I have placed lone pairs on the base. For each acid/base reaction shown below (a-d), do the following:

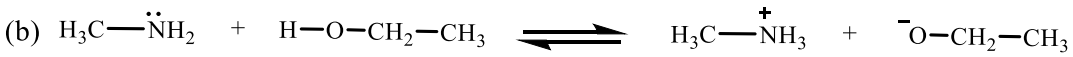
(i) Label the acid (A) and base (B) <u>reactants</u>, and label the conjugate acid (CA) and conjugate base (CB) <u>products</u>;

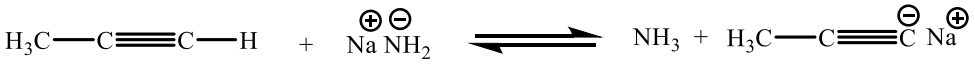
(ii) Using the pKa table, label each acid (A) and conjugate acid (CA) with their <u>approximate</u> pKa's.

Example:



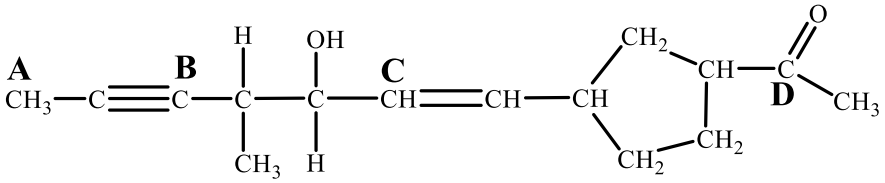
(a) $H_2SO_4(aq) + 2\ Na^+(aq) + 2\ OH^-(aq) \rightleftharpoons SO_4^{-2}(aq) + 2\ H_2O(l) + 2\ Na^+(aq)$



(c) 

(d) 

(3) REVIEW. For the compound drawn at the right, indicate the number of:



(a) 1º carbons _____ 2º carbons _____ 3º carbons _____

(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? _____

(c) Indicate the **Hybridization and Molecular Geometry** for the atoms labeled A-D:

A _____ **C** _____

B _____ **D** _____

(c) Based on the functional groups in this compound, which of the following IR bands might be present (circle):

1700 **2100** **3300** **3200-3600**

(4) REVIEW. Two un-labeled vials were found in the organic chemistry stockroom. The crystalline solids in each vial were analyzed, and found to have the same molecular formula: $C_9H_{18}O$. Are the following statements about these compounds **TRUE or FALSE:**

_____ They may be constitutional isomers or identical

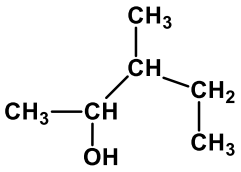
_____ The Hydrogen Deficiency is 4 (if false, then what is the HD?) _____

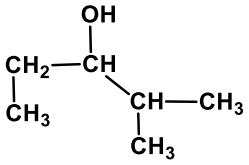
_____ The unknowns may be an alcohol or an ether or contain a carbonyl

_____ Each unknown contains a double bond or a ring

_____ If a ring is present, then **all** carbon atoms must be sp3 hybridized

(5) REVIEW. Comparing Organic Structures. Are the following pairs of compounds: Identical, Different, or Constitutional Isomers?





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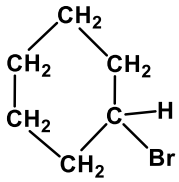

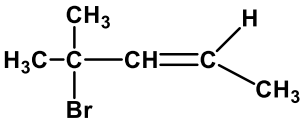

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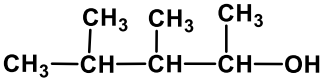

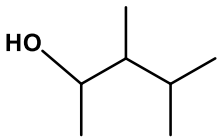

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