Chem 221 W09 Sect 02 Dr. C. Rogers **NAME:**

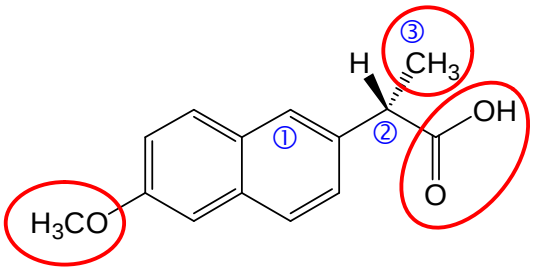
INTRODUCTORY ORGANIC CHEMISTRY I --- **PROBLEM SET #1**

INSTRUCTIONS: ANSWER ALL QUESTIONS ON THESE PAGES. HAND IN (stapled, double-sided, no extra pages) **AT THE BEGINNING OF CLASS on Thursday Feb.12th**. KEEP A COPY OF YOUR WORK TO COMPARE WITH THE ANSWER KEY (POSTED DAY AFTER SUBMISSION DEADLINE). LATE SUBMISSIONS WILL **NOT** BE ACCEPTED.

 # 1. Draw line (skeletal) structures of the isomeric compounds shown and rank them in order of decreasing solubility in water (i.e., most soluble = ①; least soluble = ③). Explain briefly.

$(CH_3)_3COH$ $CH_3OCH_2CH_3$ $CH_3(CH_2)_2OH$

 # 2. Naproxen, shown here, is the active ingredient in several anti-inflammatory painkiller drugs sold in the United States. Answer the following questions about this molecule:



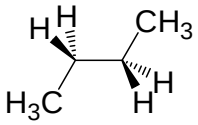
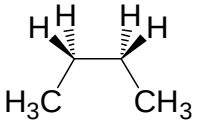
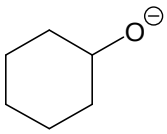
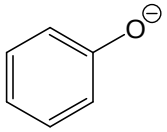
a) Name the circled functional groups.

b) The pH of stomach acid is about 2. In your stomach, would this molecule exist predominantly in the form shown here or in its deprotonated/protonated form? Explain in a <u>few</u> key words.

c) Consider the C-H bonds on the three numbered atoms. Which of those C-H bonds would be the shortest? Why?

d) Are the π-systems in the two fused rings isolated (localized) or conjugated (delocalized)? Explain in a few words.

 # 3. Complete the table….

Criterion	**Choices (circle your choice)**	**Explain in a <u>few</u> TECHNICAL words**
Which is more stable?	$CH_3\overset{\oplus}{C}HCH_2$ $CH_3CH\overset{\oplus}{C}H_2CH_3$	
Which has more torsional strain?	 	
Which is more basic?	 	
To break a σ-bond, a pair of electrons must enter its…	σ-orbital σ*-orbital	

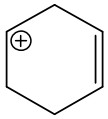
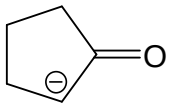
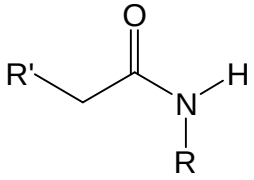
 # 4. Inductive electron withdrawal by electronegative groups ("EWGs") and its impact on base strength were discussed in class. Inductive electron donation can also occur, wherein alkyl groups act as electron-donating groups ("EDGs") via a phenomenon known as hyperconjugation (see Bruice section 4.2, but note context there is carbocation stability, not basicity).

Your tasks:

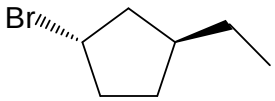
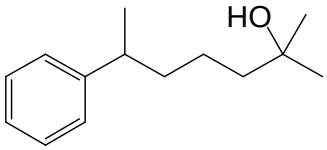
1) Provide the common name and the IUPAC name for each amine shown.
2) Use inductive effects to rank the three isomeric amines shown below, from highest to lowest basicity (i.e., strongest base = ①; weakest base = ③). Explain your answer.

$CH_3CH_2CH_2NH_2$ $(CH_3)_3N$ $(CH_3CH_2)_2NH$

 # 5. Analyze each structure shown, by following the instructions in the first row of the table.

Complete each structure: Draw <u>all</u> implied hydrogen atoms & lone pairs. Do not alter formal charges.	**Analyze for resonance & explain (in a few words):** If resonance-stabilized: Draw the other major contributor. Circle the most stable one & explain why. If no resonance occurs: Explain why delocalization is not possible.
	
	
 **a peptide** R, R' = alkyl groups	

 # 6. Complete the following table.

Systematic (IUPAC) name	**Line (skeletal) structure**
	
propoxybutane	
	
cis -1-methyl-2-(2-methylpropyl)cyclohexane	

 # 7. Ethyl alcohol (ethanol) and diethyl ether (ethoxyethane) are two solvents commonly used for organic reactions. If you want to use sodium acetylide (NaC≡CH) as a reagent, only one of these solvents would be suitable, however. Which one is it, and why? Also, would it be important to remove traces of water from your solvent before adding this reagent? Why?

 # 8. Consider this incorrectly named molecule: "2-isopropyl-5-bromocyclohexane".

a) Write the correct name for this molecule (but you can still use the common "isopropyl" name), and draw its two geometric isomers.

b) Draw the chair-chair interconversion (ring-flipping) equilibrium for the trans isomer of this molecule, and label <u>all</u> the axial and equatorial positions.

c) In an equilibrium sample of this substance, which conformer from **(b)** would another molecule be most likely to collide with? Explain your answer.