

<b>INTRODUCTORY ORGANIC CHEMISTRY I --- PROBLEM SET #1</b>
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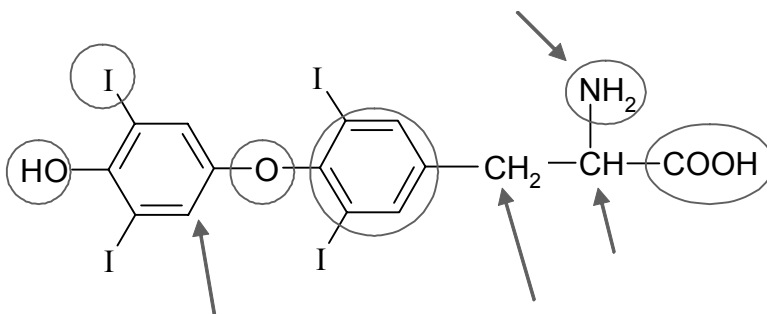
**INSTRUCTIONS:** HAND IN STAPLED, COMPLETED ASSIGNMENT (no extra pages please) AT THE BEGINNING OF CLASS on Thursday Jan.27. LATE SUBMISSIONS WILL NOT BE ACCEPTED. YOU MUST ANSWER ALL QUESTIONS, BUT I WILL ONLY MARK 3 OF THEM. NOT ALL THE MATERIAL HAS BEEN COVERED; SOME REQUIRES REVIEWING GENERAL CHEM I & II MATERIAL, AND SOME WILL BE COVERED SOON IN CLASS.

# 1. Complete the following table about the structures of some common organic compounds.

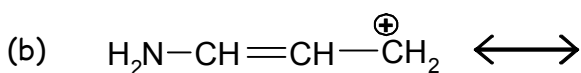
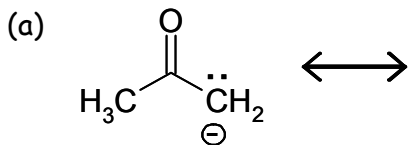
Common name	IUPAC name	Condensed formula	Lewis Structure (not Kékulé)	Line structure	Label bond polarities ( $\delta^+$ , $\delta^-$ )	Molecule polar OR nonpolar?
	ethanol					
butane						
		$\text{CH}_3\text{NH}_2$				

# 2. Thyroxine, shown below, is the main hormone secreted by the thyroid gland.

- (a) Label the hybridization of all atoms indicated by arrows.
- (b) Name the circled functional groups. Whenever appropriate, use the descriptors primary ( $1^\circ$ ), secondary ( $2^\circ$ ) or tertiary ( $3^\circ$ ).



# 3. Draw a resonance structure for each species (show all lone pairs & formal charges). For each pair, circle the more stable resonance contributor, and explain your choice.



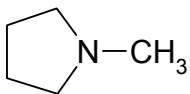
# 4. Consider the following condensed structural formula:  $\text{CH}_3\text{C}_2\text{CHO}$

(a) Draw the molecule's full Lewis structure. Circle the atoms that lie in the same plane.

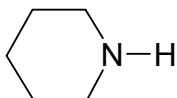
(b) Draw orbital pictures (valence bond theory style) of the  $\pi$ -bonding in the molecule.

- # 5. *N*-methylpyrrolidine (common name) has a much **lower** boiling point than piperidine (common name). What causes the large boiling point difference between these two isomers? Your explanation must include drawings AND the following key words:

*electronegativity, polarity, geometry, intermolecular.*

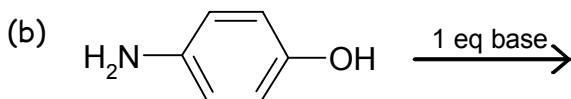
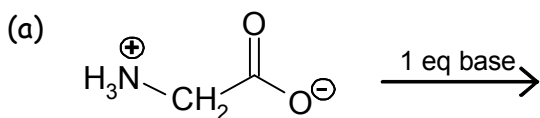


*N*-methylpyrrolidine  
b.p. 81°C

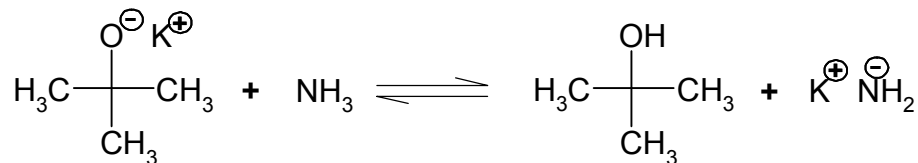


piperidine  
b.p. 106°C

- # 6. If the following compounds are treated with one molar equivalent of a sufficiently strong base, what anionic species will form? (*i.e.*, draw the conjugate base...) Explain your choice.



# 7. Is potassium *tert*-butoxide a useful base if you want to prepare the amide anion,  $\text{NH}_2^-$ ? Explain using a discussion of the following reaction and appropriate  $\text{pK}_a$ s. *Hint: see back cover of Bruice....*



# 8. Draw 3-dimensional structures of the products of the following Lewis acid-base reactions. Show curved arrows to represent the electron-flow mechanism for each reaction, and identify the electrophile and the nucleophile.

