Did you prepare?
Amine, we do have an exam today!

Thanks to for Chaise S. the title!

Organic Chemistry I
CHE 310 002, Exam #1

100 well practiced points
September 21, 2018

Rules of the road:

1. There are 10 questions on 5 pages plus a couple of extra credit questions.
2. No notes are allowed.
3. No electronic devices of any kind are allowed. This includes, but is not limited to the following: PDAs, cell phones, pagers, calculators, mp3 players, ear buds and multifunctional watches.
4. No, I am not kidding!
5. Read the agreement and sign below before you begin.
6. Good Luck!

K.C. Russell

I hereby recognize that I am subject to and agree to abide by the *Northern Kentucky University Honor Code*, which provides standards that encourage ethical academic behavior and imposes penalties for violations of such standards.

Printed Name : _____

Student ID# _____
Last four of SSN or last eight of ISO

Signature : _____

1. Get organized. Read the entire question before you attempt to answer. (8 points)
   Consider the formula $\mathbf{C_8H_{12}O_2}$
   a. ***Draw*** four constitutional isomers of $\mathbf{C_8H_{12}O_2}$. Hint: C+1 – ((H+X-N)/2)
   b. ***Clearly identify and name*** one different functional group in each structure. (The same functional group can be present in more than one isomer, but you can only use its name once. You may not use *alkane* or *carbonyl* as functional groups.) No credit will be given for structures which have atoms with formal charges or unfilled valences.

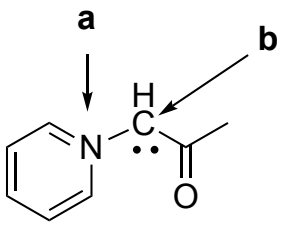
2. **Fill in the blanks** with the **formal charge (a** and **b)** or the **number of electron pairs (c and c)** or that each indicated atom possesses based on the information given. (4 points)

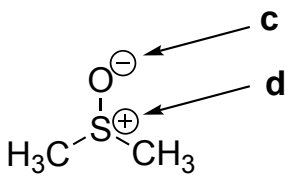
a. _____

b. _____

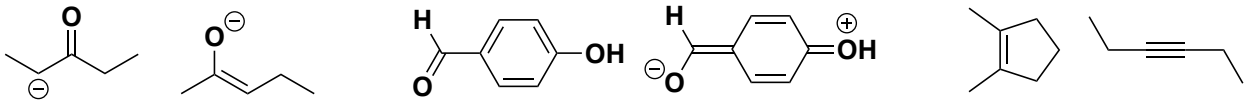
c. _____

d. _____

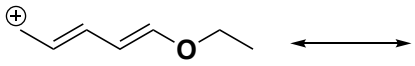




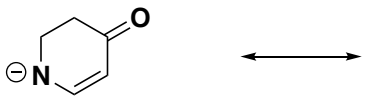
3. ***Clearly label*** each pair of compounds below as resonance contributors, constitutional isomers, or non-isomeric. (6 points)



4. For each ion below… (16 points)
   a. ***Draw*** the other relevant resonance contributors that distribute the charge.
   b. Use ***curved arrows*** to show all implied electron motion from one resonance contributor to the next. Include the motion which takes you from your final structure back to the first.
   c. ***Circle*** the most stable resonance contributor(s), if there is one (are any). If all contributors are of the same energy write, "SAME".
   d. In a couple of words **explain** your answer in part c.

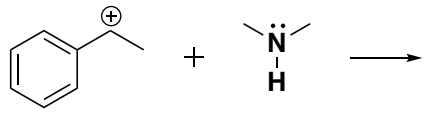


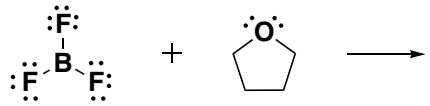
Explanation:



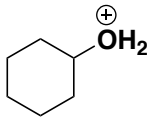
Explanation:

5. a. ***Draw*** the structure of the product(s) that result from each acid / base reaction.
   b. Use ***curved arrows*** to show all electron motion. Be sure to include any formal charges
   (12 points)

a) 

b) 

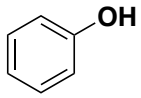
6. **Rank** the following molecules in order of *increasing* acidity. (8 points)



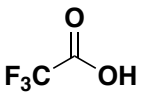
A

HI

B



C



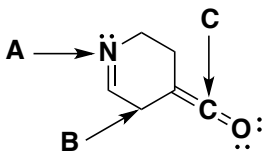
D

_____ < _____ < _____ < _____

Least acidic — Most Acidic

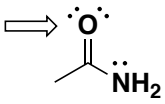
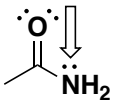
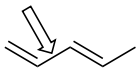
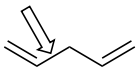
7. a. **Fill in the table** for the indicated atoms using the molecule on the right. (8 points)

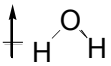
Atom	hybridization	angle between hybrid orbitals
A		
B		
C		



b. In what type of orbital are the lone pair electrons on the N atom located?
Briefly explain your answer.

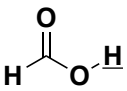
8. For each pair below: (20 points)
   a. ***CIRCLE*** the molecule that best fits the description on the right. If both molecules fit the description equally circle them both and write "same". (2 pts)
   b. Provide a brief explanation including the fundamental physical property behind the trait. Typically one sentence will do. If your answer to part is, "same," provide your reasoning. (2 pts)

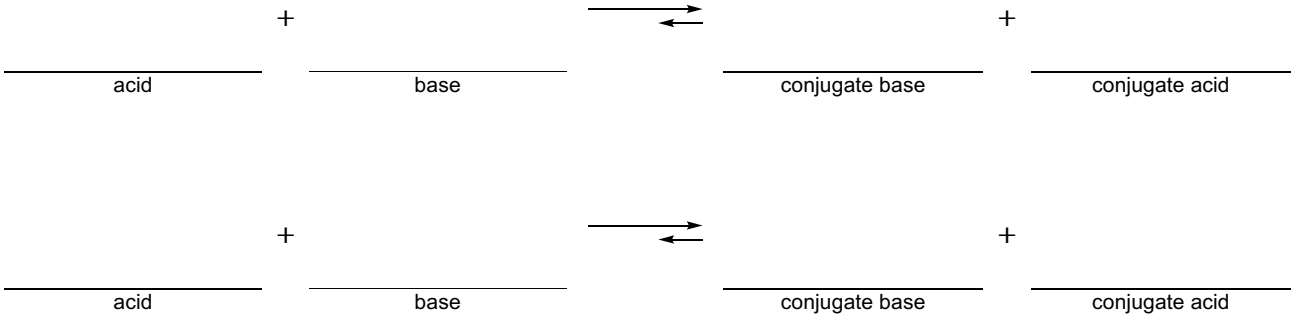
a)	**heptane**	***vs.***	**2,4-dimethylpentane**	**Compound with lower boiling point**
b)		***vs.***		**Atom where a proton (H^+) would add**
c)	**CH_3NO_2**	***vs.***	**CH_3Cl**	**Molecule that contatains the more acidic proton**
d)		***vs.***		**longer carbon-carbon sigma bond**
e)		***vs.***		**correct 2-D representation of 2,2-dimethylpropane**

9. a. Using the correct combination of straight, wedged and dashed lines ***re-draw*** the compounds below in three-dimensional form with correct bonding. (10 points)
   b. ***Check the boxes*** below each molecule to indicate whether that compound has a dipole moment ($\mu \neq 0$) or not ($\mu = 0$).
   c. For those compounds that have dipole moments ***indicate the direction of the dipole***. 

$H_2C{=}C{=}CCl_2$	CH_3CH_2Li
☐ $\mu = 0$ ☐ $\mu \neq 0$	☐ $\mu = 0$ ☐ $\mu \neq 0$
3D structure and direction of dipole moment (if any)	

10. Using the molecules and their pKa values in the box below, write two favorable acid/base reactions. Each molecule must appear in your answers as is or as its conjugated base. *Do not use a given molecule more than once.* (8 pts)

$H{-}Cl$		$H_3C{-}OH$	$H{-}C{\equiv}C{-}H$
pKa = -7	pKa = 3.7	pKa = 16	pKa = 25



Extra Crud:

1. In what year did your laureate win his / her Nobel Prize? (2 pts)

2. In 1828 Friedrich Wöhler synthesized the first organic molecule. Give either its name or structure. (2 points)