

CHM 333
In-Class Exam #1
September 24, 2008

E. B. Skibo

Print Name _____

Sign Name _____

Student I.D. # _____

PLEASE PRINT YOUR NAME ON LAST PAGE TOO. ANSWER QUESTIONS ONLY IN THE SPACES PROVIDED. DO NOT WRITE ON THE BACK OF PAGES, I WILL NOT GRADE ANSWERS ON THE BACK OF PAGES.

1. (30 pts) Multiple choice/ fill in the blanks. Put your answer in the space provided.

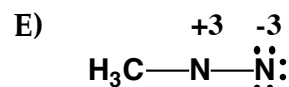
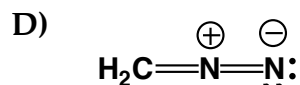
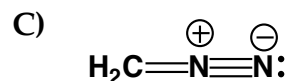
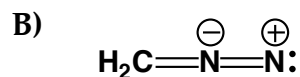
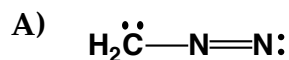
C a) The atomic number of boron is 5. The correct electronic of boron is:

- A) $1s^2 2s^3$
- B) $1s^2 2p^3$
- C) $1s^2 2s^2 2p^1$
- D) $2s^2 2p^3$
- E) $1s^2 2s^2 3s^1$

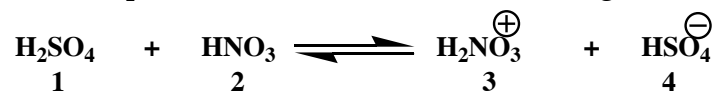
A b) Which of the following is the strongest acid?

- (A) $\text{CH}_3\text{CH}_2\text{OH}$
- (B) CH_3OCH_3
- (C) CH_3NHCH_3
- (D) $\text{CH}_3\text{C}\equiv\text{CH}$
- (E) $\text{CH}_3\text{CH}=\text{CH}_2$

D c) Which of the following Lewis dot structures, including formal charges, are correct for diazomethane, CH_2N_2 ?



C d) Which species act as bases in the following reaction?



A) 1 and 2

D) 1 and 3

B) 3 and 4

E) 2 and 3

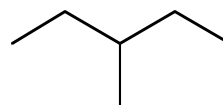
C) 2 and 4

C e) Which of the following has the lowest boiling point?

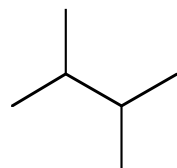
A)



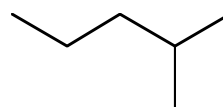
B)



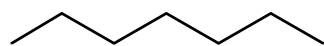
C)



D)

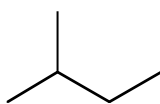


E)

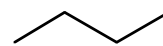


D f) Which of the following has the greatest van der Waal's interaction between molecules of the same kind?

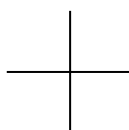
A)



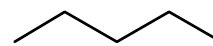
B)



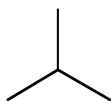
C)



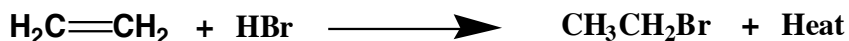
D)



E)



D g) Which of the following correctly describes the reaction shown?

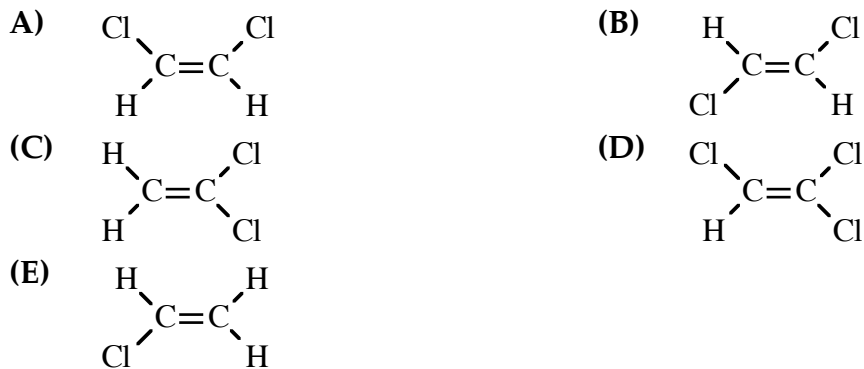


- A) $\Delta H^\circ > 0$ and $\Delta S^\circ > 0$ B) $\Delta H^\circ > 0$ and $\Delta S^\circ < 0$
C) $\Delta H^\circ < 0$ and $\Delta S^\circ > 0$ D) $\Delta H^\circ < 0$ and $\Delta S^\circ < 0$
E) $\Delta H^\circ = 0$ and $\Delta S^\circ = 0$

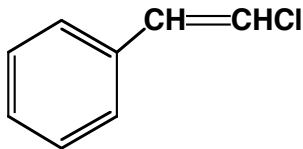
C h) Which of the following describes the most stable conformation of *trans*-1-*tert*-butyl-3-methylcyclohexane?

- A) Both groups are equatorial.
B) Both groups are axial.
C) The *tert*-butyl is equatorial and the methyl group is axial.
D) The *tert*-butyl group is axial and the methyl group is equatorial.
E) None of these.

B i) Which of the following molecules has a net dipole moment of zero?

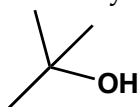


C j) Which of the following is vinyl chloride?

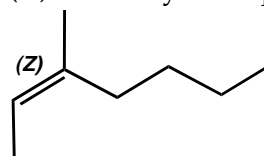
- A) $\text{CH}_3\text{CH}_2\text{Cl}$
B) $\text{H}_2\text{C}=\text{CHCH}_2\text{Cl}$
C) $\text{H}_2\text{C}=\text{CHCl}$
D) 
E) $\text{ClCH}=\text{CHCl}$

2. (30 pts) Write the structure corresponding to the following names.

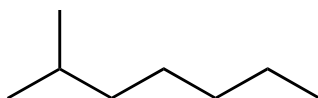
a) *tert*-Butyl Alcohol



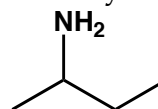
b) (Z)-3-Methyl-2-heptene



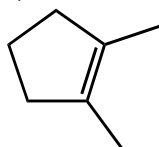
c) Isooctane



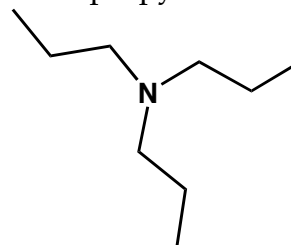
d) *sec*-Butylamine



e) 1,2-Dimethylcyclopentene

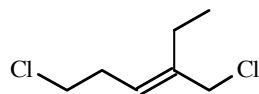


f) Tri-*n*-propylamine



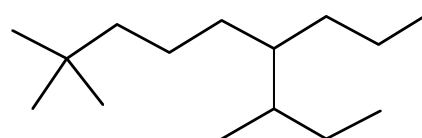
3. (30 pts) Provide a systematic or common name for each of the following structures. Use *cis/trans* and E/Z where required.

a)



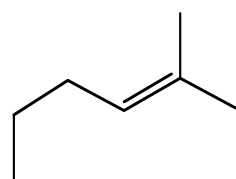
(E)-1-Chloro-4-(chloromethyl)hex-3-ene

b)



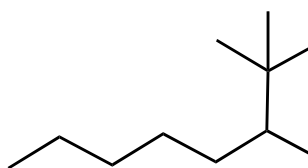
2, 2, 7-trimethyl-6-propylnonane

c)



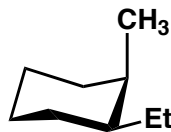
2-Methylhex-2-ene

d)



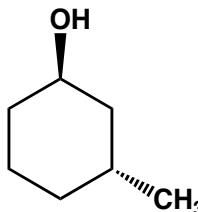
2,2,3-Trimethyloctane

e)



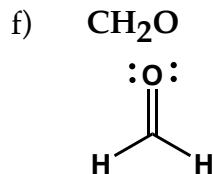
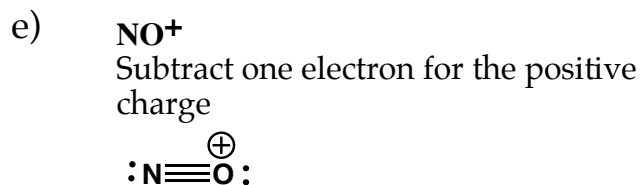
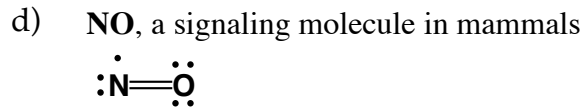
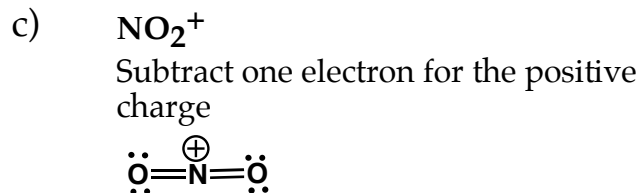
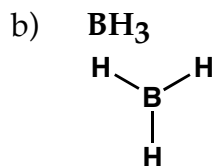
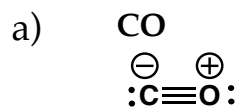
***cis*-1-Ethyl-2-methylcyclohexane**

f)

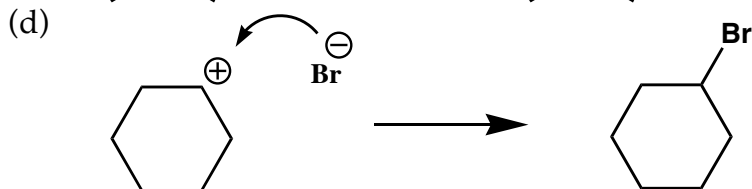
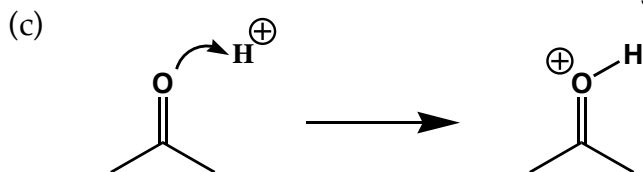
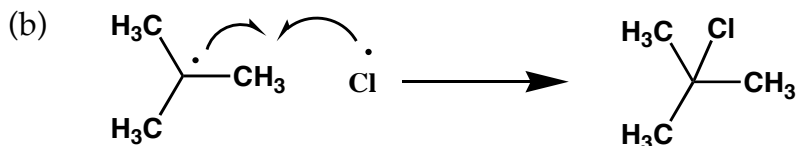
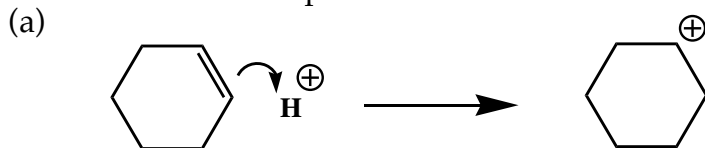


***trans*-3-Methylcyclohexanol**


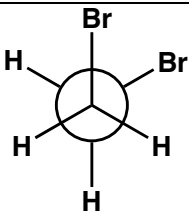
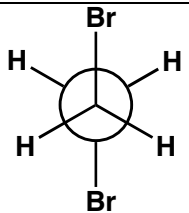
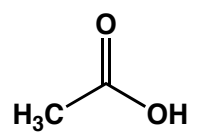
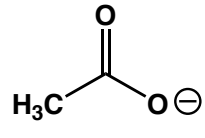
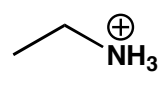
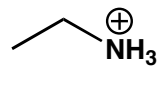
4. (30 pts) Write a Lewis structure for each of the following compounds. You may use lines for bonds but please show all lone pairs and charges if any.



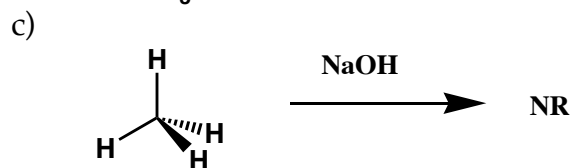
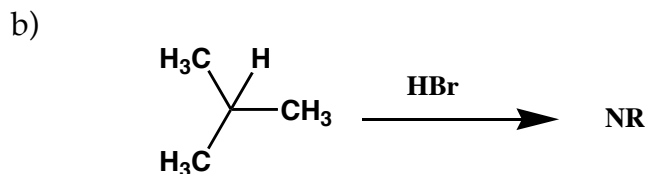
5. (20 pts) Using Curved Arrows. Show the curved arrows on the first structure in that result in the corresponding resonance structure or reaction product.



6. (25 pts) Draw the requested structures.

<p>A) Draw <i>trans</i>-1-ethyl-2-methylcyclohexane in its lowest energy chair conformation. (5 pts)</p>		
<p>B) Using Newman Projections, draw the gauche and anti staggered conformations of 1,2-Dibromoethane.</p>		
	<p>Gauche (5pts)</p>	<p>Staggered Anti (5pts)</p>
<p>D) Draw the structure of the predominate form of CH_3COOH ($\text{p}K_a = 4.8$) at $\text{pH} = 6$.</p>		
<p>E) Draw the predominate form of $\text{CH}_3\text{CH}_2\text{NH}_3^+$ ($\text{p}K_a = 11.0$) at $\text{pH} = 10$</p>		

7. (15 pts) Predict the major product of each of the following reactions. If there is no reaction, write no reaction or NR.



8. (20 pts) Provide the requested rankings along with a brief explanation of each of your answers.

a) Rank the following anions by base strength:



A



B



C

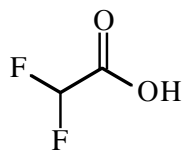


strongest base

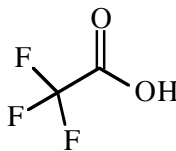
weakest base

Use electronegativity to rank anions by stability. The more electronegative the atom bearing the anion, the more stable the anion. Therefore, anion A is the most stable, anion B is the least stable, and anion C is in-between. Stability of the anion is related to its tendency to accept a proton (basicity). The least stable anion (C) is the strongest base because the relatively stable species methane results upon protonation. Conversely, methoxide (A) is the most stable anion and is the weakest base.

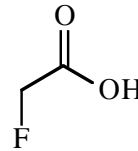
b) Rank the following acids by pKa



A



B



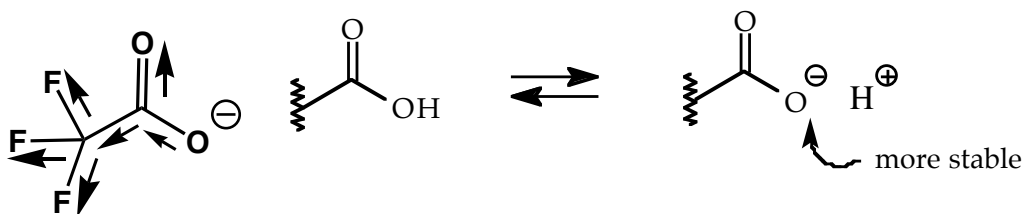
C



highest
pKa

lowest
pKa

As the number of fluoro substituents increase, the stability of the conjugate base increases due to additional electron withdrawing inductive (through bond) effect:



As the conjugate base becomes more stable, the pKa value decreases.