

COMPLETE THIS SECTION : Up to TWO POINTS will be removed for incorrect/missing information!

PRINTED FIRST NAME _____ PRINTED LAST NAME _____

Person on your LEFT (or Empty or Aisle) _____

Person on your RIGHT (or Empty or Aisle) _____

Class you are REGISTERED FOR (onground or hybrid) _____

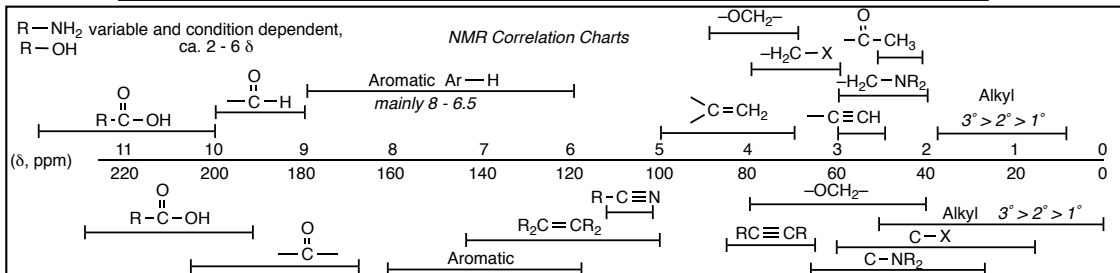
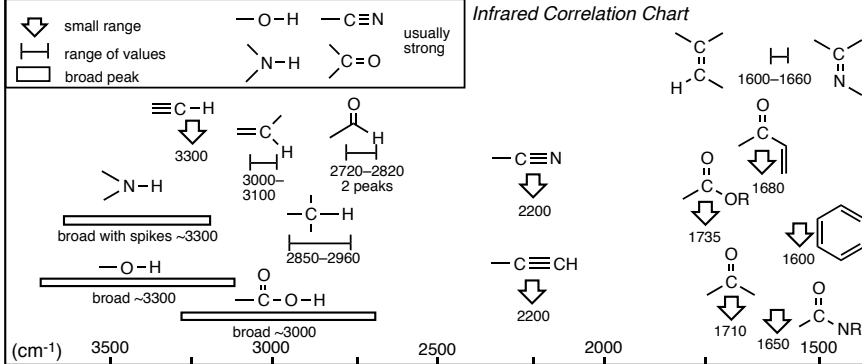
The room where most students will take the test for your class, i.e. LS A-191 for onground and PS H-152 for hybrid) _____

****YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM****

- | | |
|---|----------------------------------|
| • PRINT YOUR NAME ON EACH PAGE! | • WRITE CLEARLY! |
| • READ THE DIRECTIONS CAREFULLY! | • MOLECULAR MODELS ARE ALLOWED |
| • USE BLANK PAGES AS SCRATCH PAPER | • DO NOT USE RED INK |
| work on blank pages will not be graded... | • DON'T CHEAT, USE COMMON SENSE! |

H																He															
Li Be														B C N O F		Ne															
Na Mg														Al Si P S Cl Ar																	
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn														Ga Ge As Se Br Kr																	
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd														In Sn Sb Te I Xe																	
Cs Ba Lu Hf Ta W Re Os Ir Pt Au Hg														Tl Pb Bi Po At Rn																	

Interaction Energies, kcal/mol			
Eclipsing		Gauche	
H/H	-1.0	Me/Me	-0.9
H/Me	-1.4	Et/Me	-0.95
Me/Me	-2.6	i-Pr/Me	-1.1
Et/Et	-3.1	t-Bu/Me	-2.7



**YOU MUST COMPLETE THIS PAGE WITH YOUR NAME
(EVEN THOUGH YOU ALREADY DID THIS ON THE COVER PAGE)
AND ALSO GIVE YOUR ASU OR POSTING ID NUMBER
WE NEED THIS NUMBER BECAUSE YOU WOULDN'T BELIEVE THE NUMBER OF
STUDENTS WHOSE NAMES WE CAN'T READ!**

PRINTED
FIRST NAME _____ *PRINTED*
LAST NAME _____ *ASU ID or*
Posting ID _____

Points by question

1 _____ / 12
2 _____ / 35
3 _____ / 30
4 _____ / 24
5 _____ / 20
6 _____ / 30
7 _____ / 24

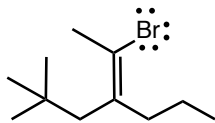
Points Removed for cover errors ____ / 2

Extra Credit ____ / 5

Total (incl Extra) _____ / 175+5

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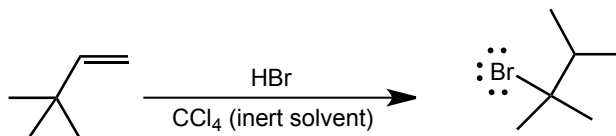
Question 1 (12 pts.) Give the IUPAC name for the following structure.



Question 2 (35 pts.)

a) Give a full curved-arrow pushing mechanism for the following reaction, indicate the Lewis acid/base (LA/LB) and Bronsted acid/base (BA/BB) at each step as appropriate.

CLASSIFY THE OVERALL REACTION as addition, elimination, substitution or rearrangement. GIVE THE NUMBER of transition states and the number of sets of intermediates in your mechanism.

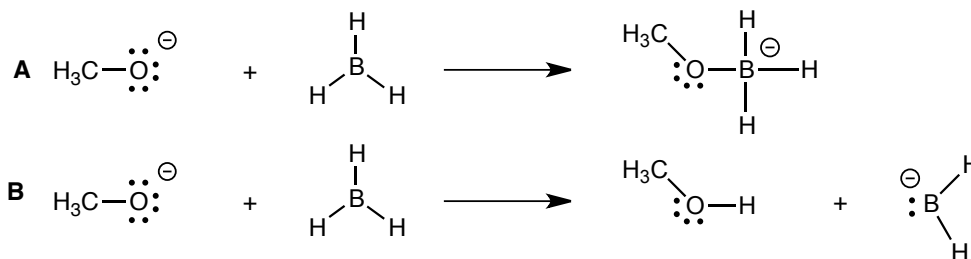


of sets of intermediates _____ # of transition states _____ classification _____

b) Draw a reaction energy diagram with properly labelled axes for the reaction above. Draw on the diagram **the activation energy for EVERY STEP of the mechanism**, and clearly indicate **which one is the rate determining step**. Also draw on the diagram the overall reaction exothermicity or endothermicity. Indicate the positions of the transition states (but do not draw the structures of the transition states).

Question 3 (30 pts)

a) For the reactions **A** and **B**, add the curved arrows that illustrate bond-making and bond-breaking, indicate the Lewis acids/bases (LA/LB) and whether they are also Brønsted acids/bases (BA/BB)



b) One of these reactions is exothermic, the other is endothermic. Decide which is which and give an explanation. Draw a reaction energy diagram for A and B **ON THE SAME DIAGRAM** (so that they can be compared, do not draw 2 different diagrams). Do not forget to properly label the axes and clearly indicate which diagram refers to which reaction!

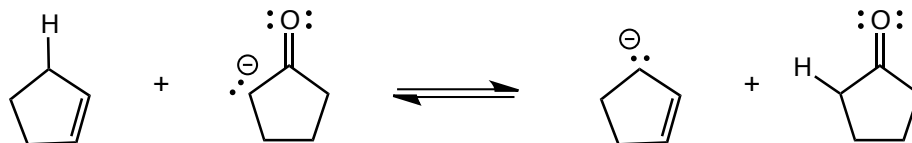
c) Indicate the activation energies for the two reactions on your energy diagram, and also indicate the exothermicity or endothermicity as appropriate. State which reaction, A or B would be FASTER, and **BRIEFLY (one sentence) explain why.**

d) Below, draw structures for the transition states for each reaction **A** and **B**.

A**B**

Question 6 (30pts.) For the following Bronsted acid/base equilibrium (not all of the H atoms are specifically shown in the line-angle structures):

- Draw the curved arrows for reaction in both directions
- Add any missing important resonance contributors for the anions on both sides of the equilibrium
- Identify the stronger acid and base on each side, indicate which acid would have the smaller pKa, indicate which reaction would be faster and give a brief explanation for your choices
- Indicate on which side the equilibrium would lie



- Draw an energy diagram with properly labelled axes for the equilibrium shown above, showing the activation energy in BOTH directions, do NOT draw the transition state

Extra Credit (5 pts) Dr. Gould had a conversation with his daughter about which topic?

cis-
and
trans-

saturated
and
unsaturated

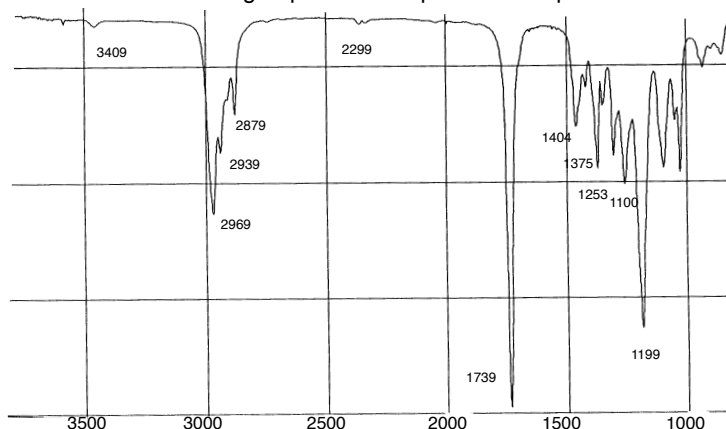
acids
and
bases

Markovnikov
and
Anti-Markovnikov

Question 7 (24 pts) Provided are spectra for a compound with molecular formula $C_6H_{12}O_2$

a) Give the degrees of unsaturation _____

b) On the infrared spectrum, indicate which peaks correspond to which functional groups (including $C(sp^3)-H$). Indicate **BOTH the functional group**, and where appropriate, **the specific BOND** in the functional group that corresponds to the peak.



c) draw the structure and clearly indicate which hydrogens correspond to which signals in the proton nmr spectrum ONLY

