

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) _____

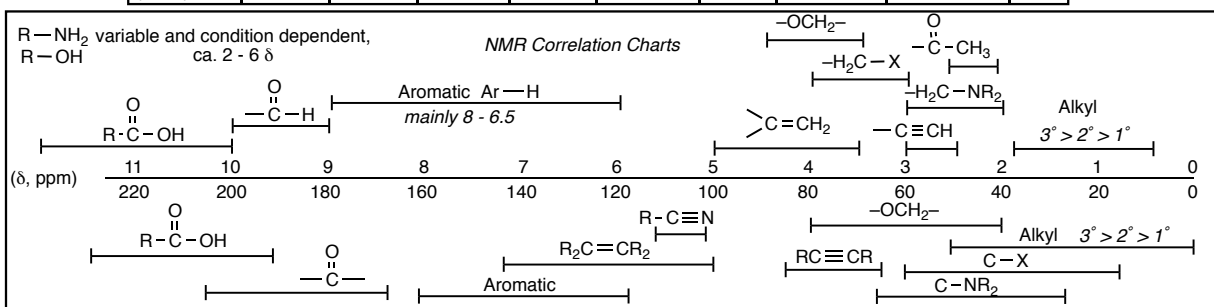
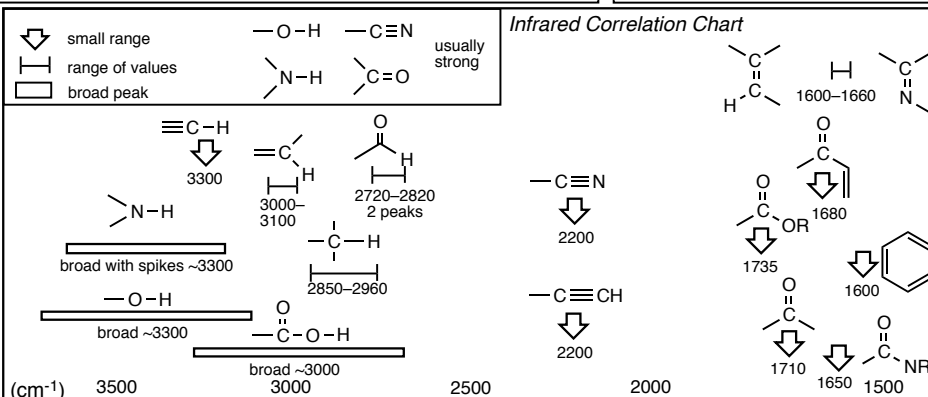
****YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM****

- PRINT YOUR NAME ON EACH PAGE!
- READ THE DIRECTIONS CAREFULLY!
- USE BLANK PAGES AS SCRATCH PAPER
- work on blank pages will not be graded...
- WRITE CLEARLY!
- MOLECULAR MODELS ARE ALLOWED
- DO NOT USE RED INK
- 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 _____ /14

2 _____ /21

3 _____ /12

4 _____ /36

5 _____ /18

6 _____ /20

7 _____ /30

8 _____ /24

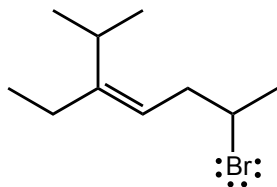
Points Removed for cover errors ____/2

Extra Credit ____/5

Total (incl Extra) _____/175+5

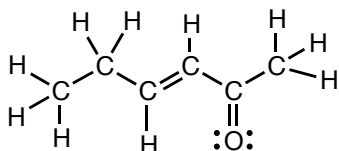
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Question 1 (14 pts.) Give the IUPAC name for the following structure, include all stereochemistry as appropriate.

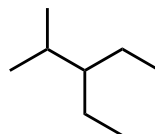
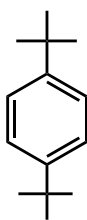


Question 2 (21 pts) For the **proton nmr spectrum** of the provided structure, circle the hydrogen atom or atoms that would have the smallest chemical shift, and also the hydrogen atom or atoms that would have the largest chemical shift, clearly indicate which is which. **Give a BRIEF EXPLANATION that includes the term DESHIELDING.**

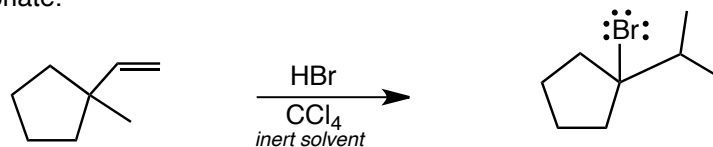
To determine which proton has the largest chemical shift you **will need to draw a minor resonance contributor**, draw this minor contributor as part of your answer, be sure to include all curved arrow pushing, resonance arrows and resonance brackets.



Question 3 (12 pts.) For each of the following 2 structures, indicate how many signals would you expect to see in a ^{13}C Carbon nmr spectrum.



Question 4 (36 pts) Give the curved-arrow pushing for the following reaction. For each INTERMOLECULAR, indicate the Lewis acid/base (LA/LB) and Bronsted acid/base (BA/BB) where appropriate.



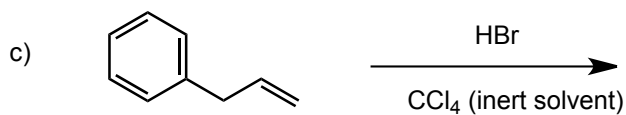
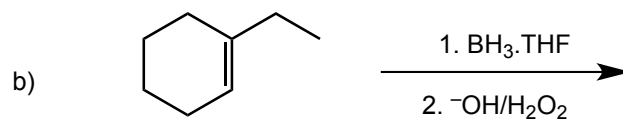
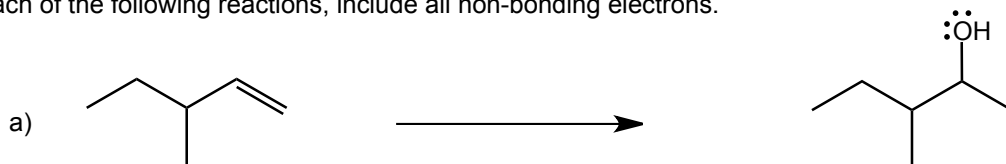
b) How many steps are there in your mechanism? _____

c) How many transition states are associated with your mechanism? _____

d) Draw a reaction energy diagram for your mechanism, label the axes, indicate the positions of the reactants, products and any intermediates (don't redraw the structures, you can circle the items on the mechanism and use arrows, or use symbols such as I1 for intermediates 1 etc.). Indicate the **ACTIVATION ENERGY FOR EACH STEP**, the **REACTION EXOTHERMICITY** and the **RATE DETERMINING STEP**.

e) Draw below the TRANSITION STATE for the rate determining step (only)

Question 5 (18 pts.) Give the missing major organic products OR reagents/conditions as appropriate for each of the following reactions, include all non-bonding electrons.



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

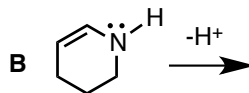
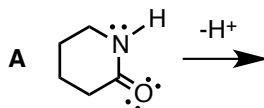
cis-
and
trans-

saturated
and
unsaturated

acids
and
bases

Markovnikov
and
Anti-Markovnikov

Question 6 (20 pts.) For the structures **A** and **B**, draw the conjugate base anion formed upon deprotonation of the hydrogen atoms bonded to nitrogen, indicated, be sure to include ALL resonance structures where appropriate. Indicate which would be the stronger Bronsted acid, **A** or **B**, and give a BRIEF explanation for your choice.

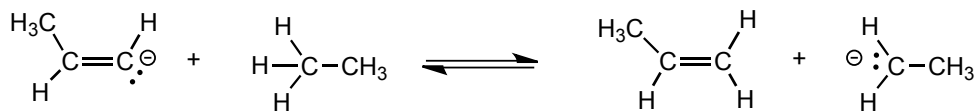


Question 7 (30 pts.) For the following Bronsted acid/base equilibrium:

1. Give the curved arrow-pushing and indicate the stronger and weaker acid and base on each side and indicate which acid has the larger and smaller pKa values

2. Draw a reaction energy diagram, indicate which reaction would be faster and on which side the equilibrium would lie, give a BRIEF explanation that includes drawing of resonance contributors as appropriate

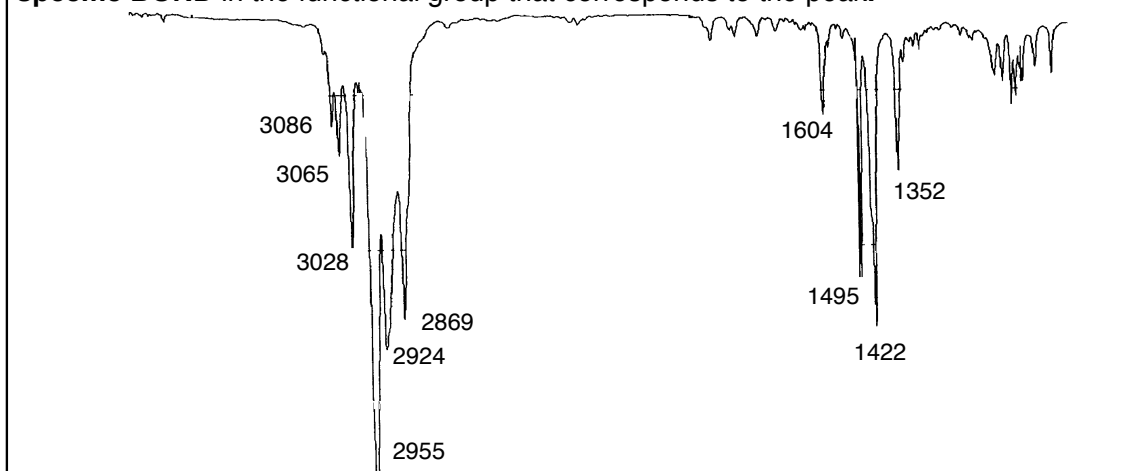
3. Give a drawing of the transition state



Question 8 (24 pts) Provided are spectra for a compound with molecular formula $C_{10}H_{14}$

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

