COMPLETE THIS SECTION : Up to TWO POINTS will be ren	noved 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)	

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- 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!

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Zr Nb	Мо Тс	Ru Rh	Pd Ag	Zn Ga Cd In	Ge Sn	P S As S Sb T	C] Se Bi	Kr Xe	Interaction Energies, kcal/moderation Energies, kcal/moderate Eclipsing Gauche H/H -1.0 Me/Me -0.9 H/Me -1.4 Et/Me -0.9 Me/Me -2.6 i-Pr/Me -1.1 Et/Et -3.1 t-Bu/Me -2.7
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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	
	1/1	2
	2/3	5
	3/3	0
	4/2	4
	5/2	0
	6/3	0
	7/2	4
	Points Removed for cover errors/2	
	Extra Credit/5	
	Total (incl Extra)/1	75+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.

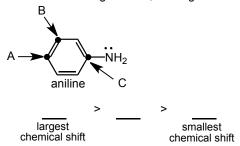
Question 4 (24 pts.) Give the missing major organic products OR reagents/conditions as appropriate for each of the following reactions, include all non-bonding electrons.

- 4 -

clearly indicate sterochemistry in the products where relevant

a)
$$\frac{H_2O}{H_2SO_4 \text{ (cat.)}}$$
b)
$$\frac{1. \text{ BH}_3.\text{THF}}{2. \text{-OH/H}_2O_2}$$

Question 5 (20 pts.) The structure of aniline is shown below. Rank the carbon atoms labelled A, B and C in order of decreasing chemical shift in a 13C (carbon) nmr spectrum. You will need to draw minor resonance contributors in order to get the correct answer to this question. Give an explanation for your answer that includes the following terms, "electron density" and "shielding and/or deshielding" (you do not need to mention local magetic field, although it will not be incorrect if you do)



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

- a) Draw the curved arrows for reaction in both directions
- b) Add any missing important resonance contributors for the anions on both sides of the equilibrium
- c) 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
- d) Indicate on which side the equilibrium would lie

e) 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- saturated acids Markovnikov and and and trans- unsaturated bases Anti-Markovnikov

Question 7 (24 pts) Provided are spectra for a compound with molecular formula C₆H₁₂O₂

