CHEM 234, Spring 2011 Second Midterm Ian R. Gould

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

*Person on your **LEFT** (or **Aisle**)* _____ *Person on your **RIGHT** (or **Aisle**)* _____

- ***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!***

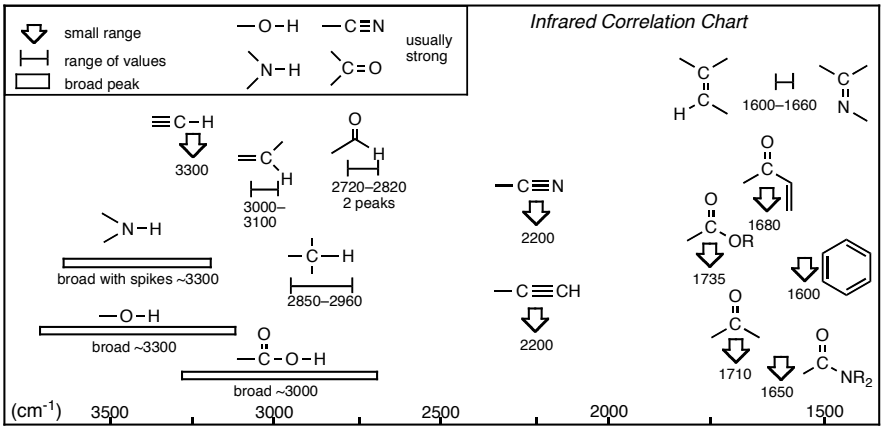
1_____**/10**.....
2_____**/20**.....
3_____**/16**.....
4_____**/23**.....
5_____**/40** .....
6_____**/24**.....
7_____**/18**.....
8_____**/24**.....

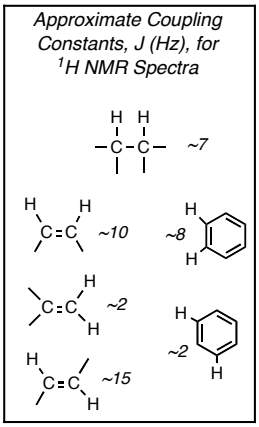
Extra Credit_____**/5** **Total (incl Extra)**_____**/175+5**

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

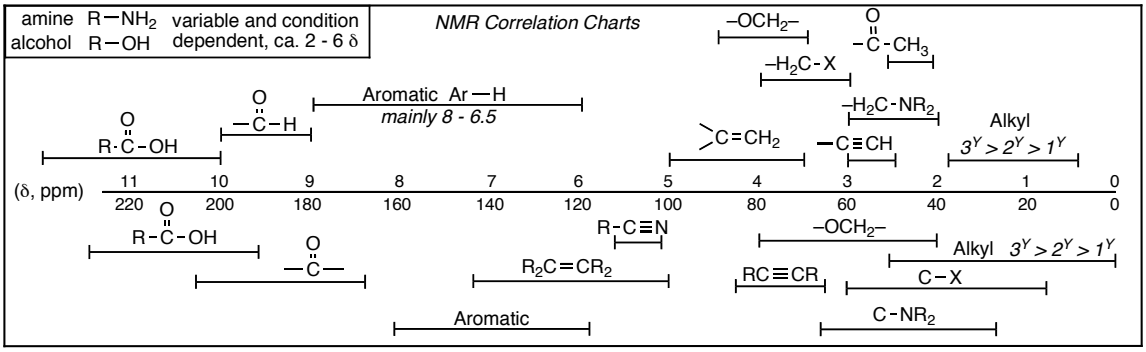
Interaction Energies, kcal/mol

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
Me/Et	~2.9	t-Bu/Me	~2.7

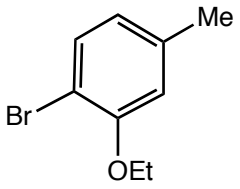




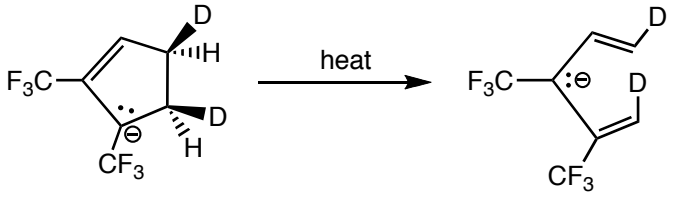
amine R—NH_2 variable and condition
alcohol R—OH dependent, ca. 2 - 6 δ



Question 1 (10 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.



Question 2 (20 pts) In this question you will be determining whether the provided reaction is allowed or forbidden



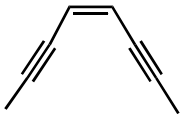
a) give the curved arrow-pushing that describes the bond-making and bond breaking

b) does the REACTION SHOWN, proceed via a conrotatory or disrotatory ring-opening?
answer _____

c) how many electrons are involved in the transition state for the provided reaction?
answer _____

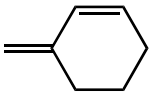
d) Give a justification for whether the REACTION SHOWN is allowed or forbidden. Your answer must include the following terms: Huckel and/or Mobius, conrotatory and/or disrotatory, aromatic, low energy and high energy transition state

Extra Credit Question (5 pts.) Which important type of biological molecule has this cis-enediyne been shown to damage?



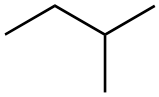
DNA proteins lipids carbohydrates

Question 3 (16 pts) Give the major organic products of the following reactions, indicate both the **relative** and the **absolute** stereochemistry.

a) 

HBr / CH_3OH (solvent)

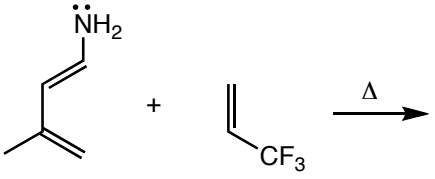
(thermodynamic control conditions)

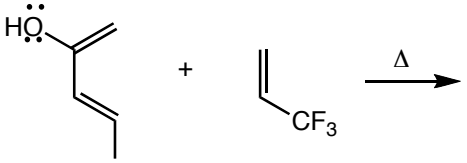
b) 

1. $Br_2/h\nu$
2. $K^+ {}^-O$-t-Bu
3. MCPBA
4. $Na^+ {}^-OEt/EtOH$

Question 4 (23 pts)

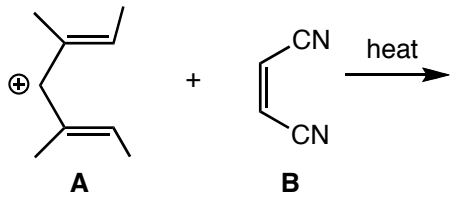
a) Give the products of the following two Diels-Alder reactions (be sure to specify both absolute and relative stereochemistry as appropriate).

A 

B 

b) Draw a reation energy diagram for these two reactions, clearly indicating which diagram refers to reaction A and which to reaction B. Clealy indicate the activation energy for the reactions A and B. Assume both reactions have similar exothermicities, indicate the exothermicity.

Question 6 (24 pts). Give the ALLOWED product of the following cycloaddition reaction



A **B**

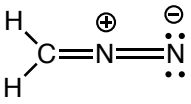
a) Give the curved arrow-pushing that describes the bond-making and breaking.

b) Redraw the cation **A** and give a pictorial representation of the wavefunction of the HOMO ON TOP OF THE STRUCTURE

c) Redraw the dicyanoethylene **B** and give a pictorial representation of the wavefunction of the LUMO ON TOP OF THE STRUCTURE

d) Give a brief justification for the structures of your allowed product, you must include the following terms in your justification: suprafacial and/or antarafacial, HOMO, LUMO, bonding and/or anti-bonding

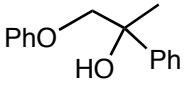
Question 7 (18 pts). For the provided structure:
a) Give all reasonable resonance contributors and indicate the hybridization of the carbon and BOTH nitrogen atoms



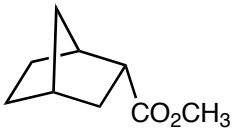
b) Redraw the structure and draw a schematic representation of the wavefunction of the LUMO on TOP of your re-drawing of the structure

Question 5 (40 pts.) Show how you would make the target componds on the right from the starting compounds on the left. Show reagents and conditions where appropriate, and the structures of important intermediate compounds. Do not show any (arrow pushing) mechanisms.

a) 



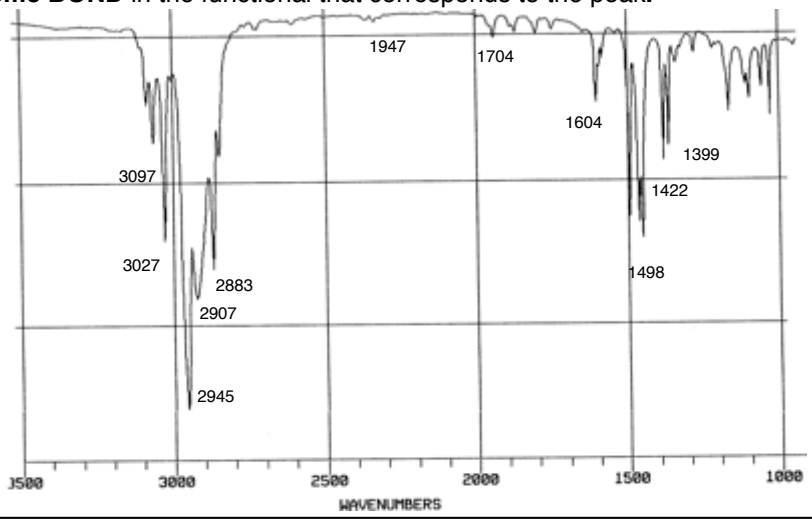
b) 



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

a) Give the degrees of unsaturation _____

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



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