CHM 234, Spring 2020 Midterm #1 Ian R. Gould

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

PRINTED **FIRST** NAME **Answer** PRINTED **LAST** NAME **Key**

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) _____

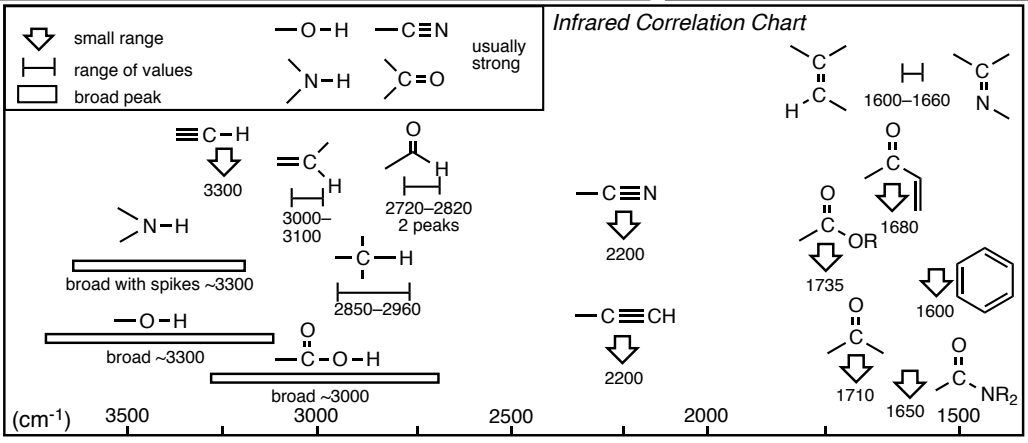
*****YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM*****

- *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_____/12

2_____/22

3_____/36

4_____/20

5_____/20

6_____/14

7_____/18

8_____/33

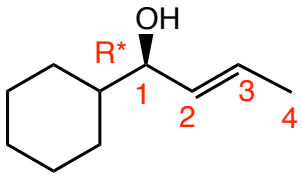
Points Removed for cover errors ____/2

Extra Credit_____/5

Total (incl Extra)_____/175+5

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

Question 1 (12 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.



1-cyclohexylbut-(2E)-en-(1R)-ol

OR

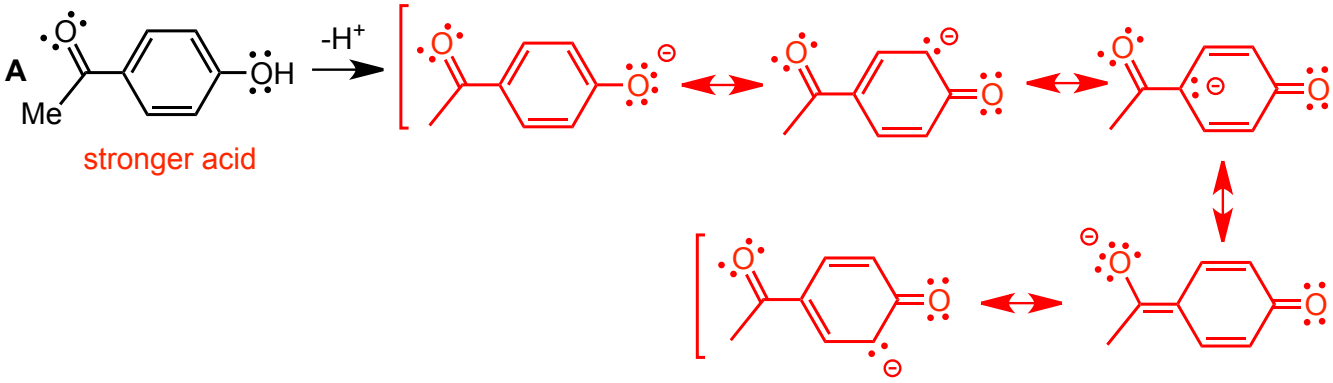
(R)-1-cyclohexylbut-(2E)-en-1-ol

OR

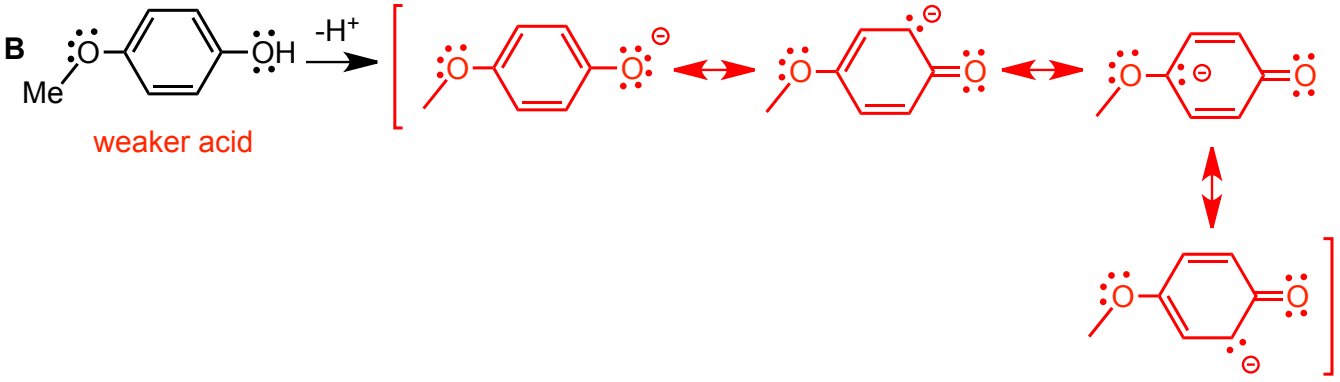
(1R)-cyclohexylbut-(2E)-en-1-ol etc.

grading- subtract 2 points each error, do not propogate errors

Question 2 (22 pts.) Which is the stronger Brønsted acid, **A** or **B**? Give a BRIEF explanation that includes drawings of ALL IMPORTANT resonance contributors of the conjugate base anions. Your explanation MUST include the following terms: "electron donating" , "electron withdrawing", "resonance" "inductive effect", and also mentions BASE STRENGTH.



stronger acid



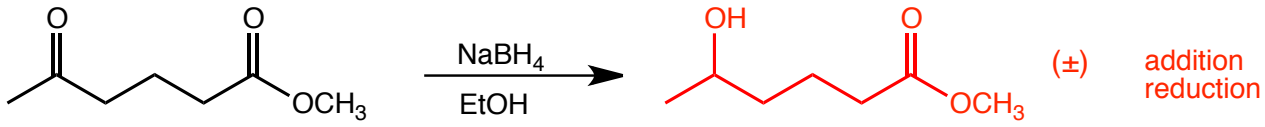
weaker acid

the substituent in A is electron withdrawing, it lowers the energy of the electrons in the conjugate base anion, which results in a weaker base that is easier to form, A is the stronger acid

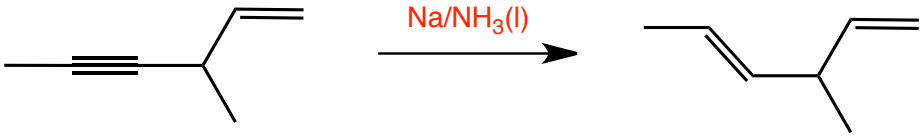
the substituent in B is electron donating, it raises the energy of the electrons in the conjugate base anion, which results in a stronger base that is harder to form, B is the weaker acid

the resonance donation effect of the substituent in B is stronger than the inductive effect, which is why it is overall donating

Question 3 (part one, 18 pts.) For each reaction
1) Provide the missing **major organic product** or **reagents/conditions** as appropriate, be sure to indicate any racemic mixtures
2) **State** whether each reaction is an Addition, Elimination, Substitution or Rearrangement
3) **State** whether each reaction is Reduction, Oxidation or Neither

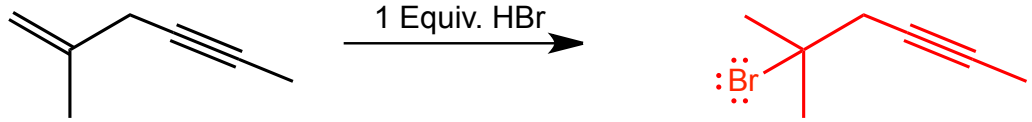
a) 

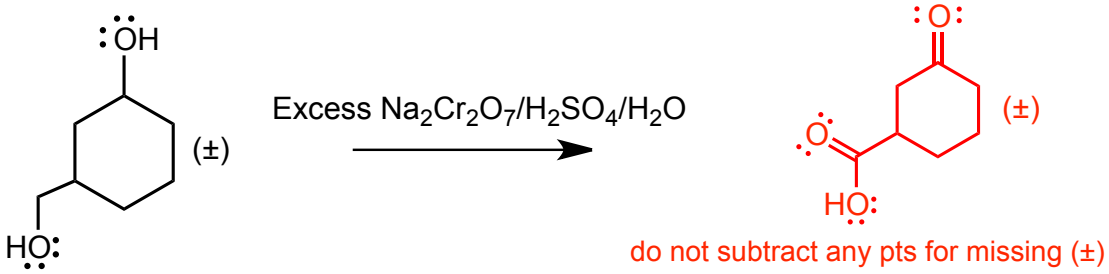
(±) addition reduction

b) 

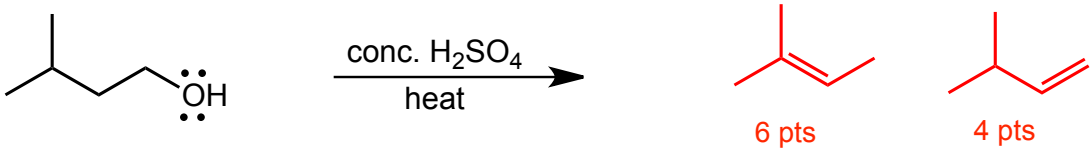
addition reduction

Question 3 (part two, 18 pts.) For each reaction:
Provide the missing **major organic product** or **reagents/conditions** as appropriate
DO NOT state whether each reaction is an Addition, Elimination, Substitution or Rearrangement
DO NOT state whether each reaction is Reduction, Oxidation or Neither

c) 

d) 

do not subtract any pts for missing (±)

e) 

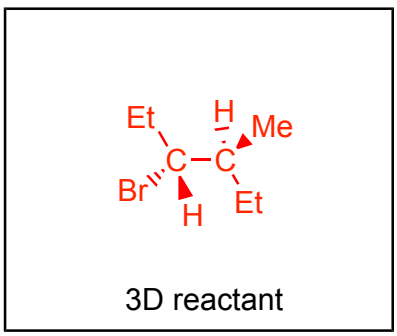
6 pts 4 pts

5 pts Extra Credit. Which functional group can be polymerized to form an organic metal?

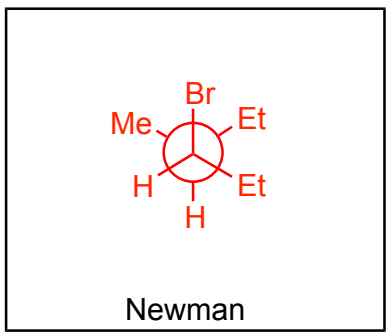
alcohol alkene (alkyne) epoxide

from "O-Chem in Real Life" page : organic metals, week #2

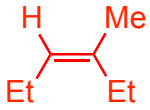
Question 4 (20 pts) For (3R)-bromo-(4S)-methylhexane:
a) Draw a line-angle ***OR*** 3-D/sawhorse structure for this molecule
b) Draw a Newman projection for the conformation that can undergo E2 elimination, **looking FROM carbon 3 TO carbon 4.**
c) Give the E2 elimination product



3D reactant

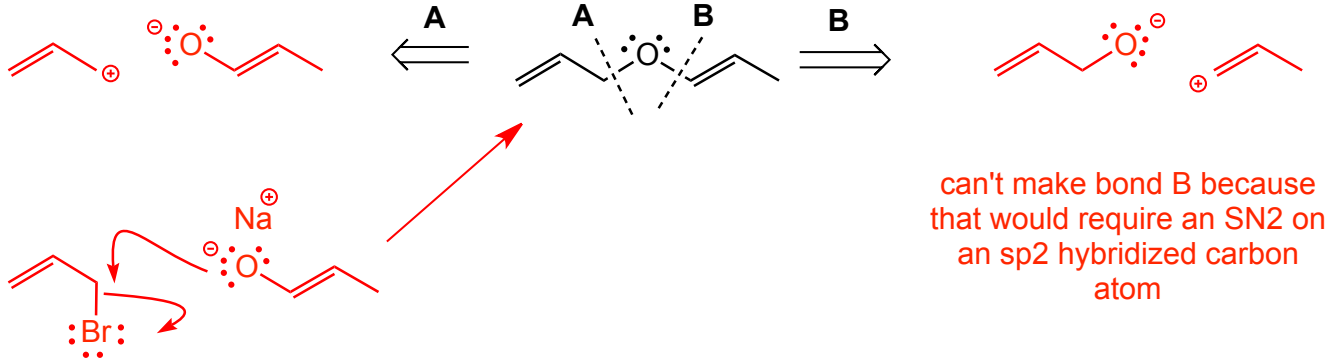


Newman



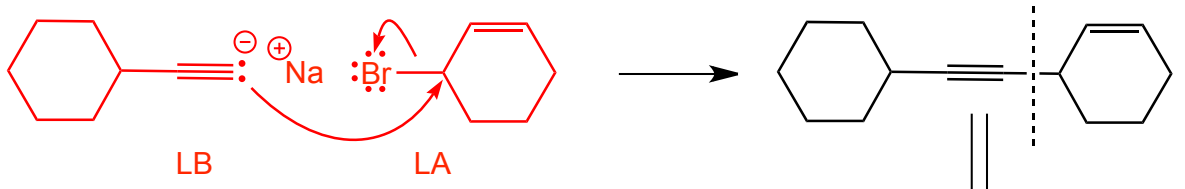
E2 product

Question 5 (20 pts.) For EACH of the two indicated bonds **A** and **B**, perform retrosynthetic analysis and draw the best synthons. Only one of these bond can actually be made, indicate which one, give the actual reactants/synthetic equivalents you would use to make that bond, give the curved arrow pushing showing bond formation and BRIEFLY explain why the other bond can not be made

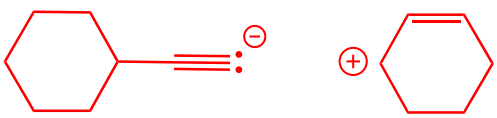


can't make bond B because that would require an SN2 on an sp2 hybridized carbon atom

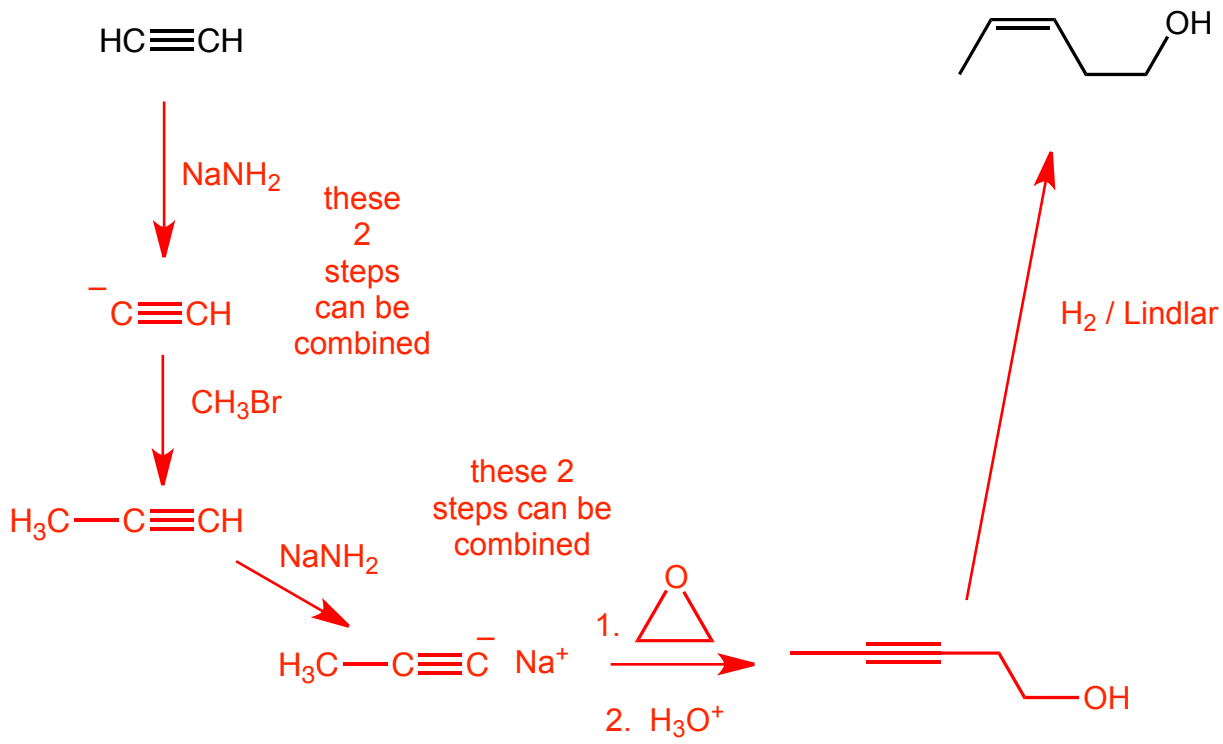
Question 6 (14 pts). Perform retrosynthetic analysis for the bond indicated by the dashed line in the target structure below, generate the best sythons and also the synthetic equivalents. Give the curved arrow pushing for the synthetic equivalents that give the target structure and label the synthetic equivalents as Lewis acid (LA) and Lewis base (LB) as appropriate.



synthetic equivalents

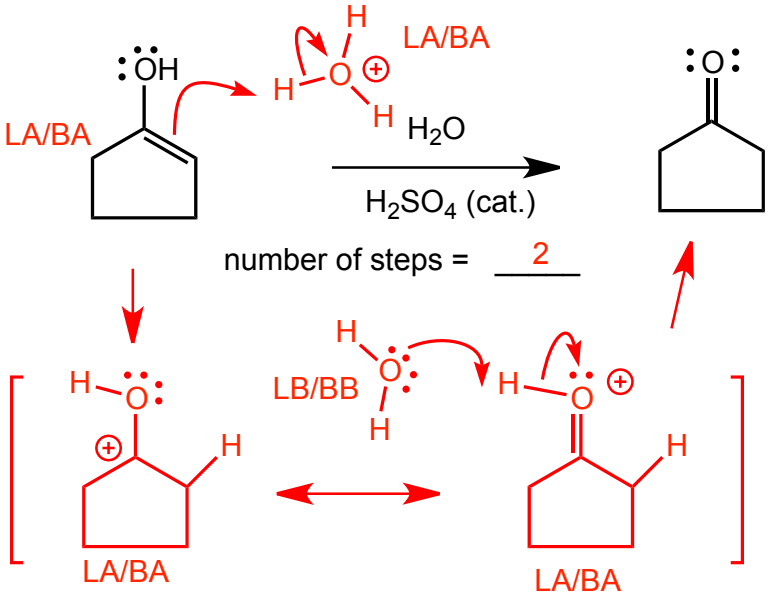

synthons

Question 7 (18 pts.) Show how you would synthesize the target structure on the right from the starting structure on the left. Show reagents and conditions, and the structures of important intermediate compounds. Do not show any (arrow pushing) mechanisms.



Question 8 (33 pts). Give a curved arrow pushing mechanisms for the following two reactions.
1) Add non-bonding electrons and C-H bonds to the line-angle structures as required.
2) Indicate the Lewis acid/Lewis base (**LA, LB**) at each INTERMOLECULAR step as appropriate, and whether they are also Brønsted acids/bases (**LA/BA, LB,BB**)
3) Include ALL IMPORTANT **RESONANCE CONTRIBUTORS** for intermediates
4) GIVE THE **NUMBER OF STEPS** IN YOUR MECHANISMS

a)



b)