CHM 234 : Spring 2020 : On Campus Class Midterm #2 (Online)

PRINTED **FIRST NAME** _____ ***PRINTED*** **LAST NAME** _____

YOUR CLASS (onground or hybrid) _____

Points by question

1_____**/11**

2_____**/24**

3_____**/24**

4_____**/22**

5_____**/38**

6_____**/20**

7_____**/14**

8_____**/22**

Extra Credit_____**/5**

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

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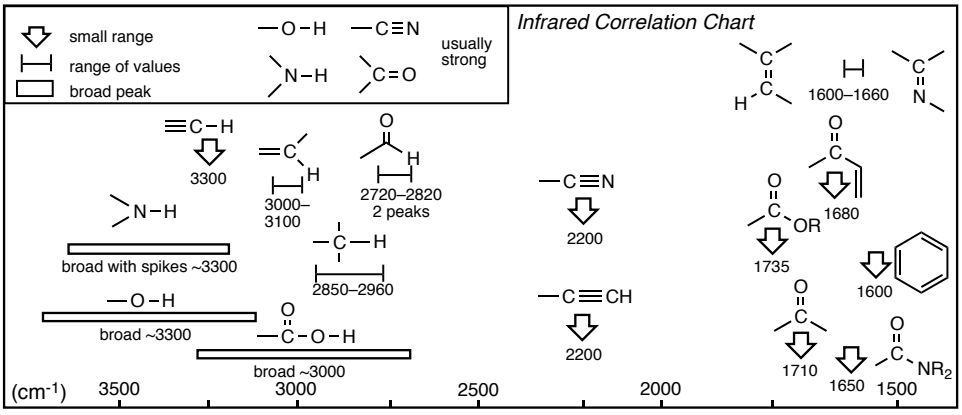
*** MOLECULAR MODELS ARE ALLOWED ***

****YOU ARE NOT ALLOWED TO KEEP SPARE COPIES OF THIS EXAM ****

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/Me	~2.9	t-Bu/Me	~2.7
Et/Et	~3.1		



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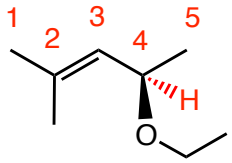
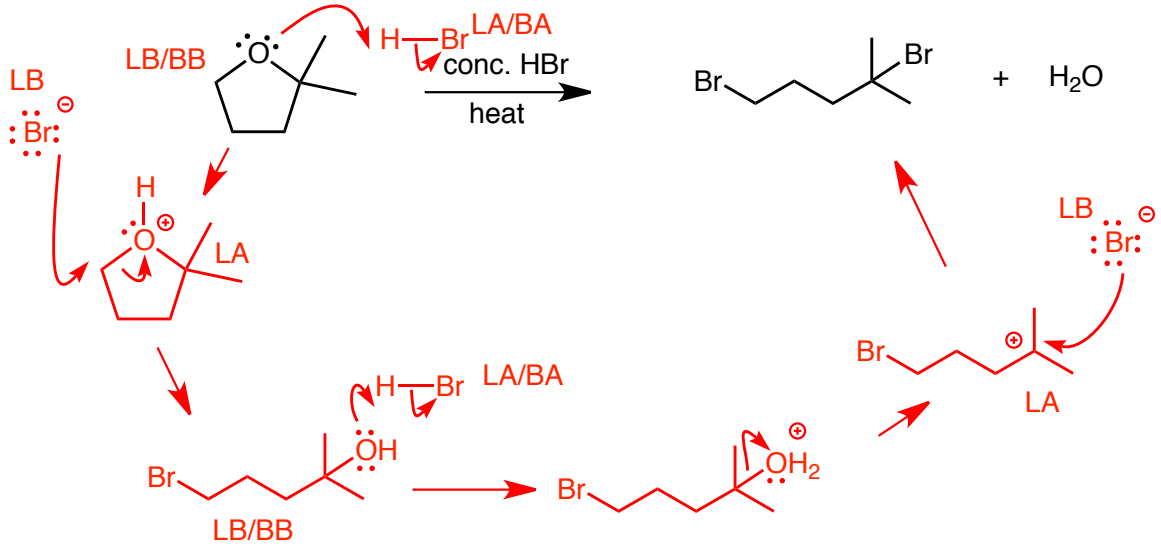
Question 1 (11 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.



(4R)-ethoxy-2-methylpent-2-ene

Question 2 (24 pts) Give a curved-arrow pushing mechanism for the following reaction. Where appropriate, indicate the Lewis acid and base (LA, BA) and the Bronsted acid and base (BA, BB).



Extra Credit (5 pts) The colors of organic molecules are determined to a large extent by the energies of electrons in?

sigma-bonding orbitals | anti-bonding orbitals | atomic orbitals

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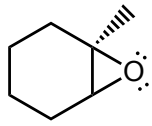
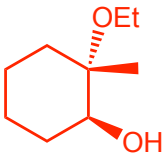
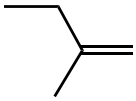
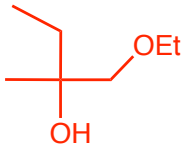
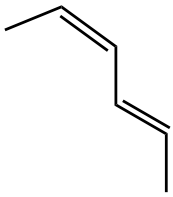
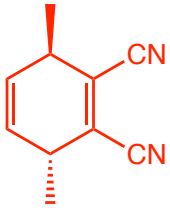
Question 3 (24 pts) Give the major organic products of the following reactions, indicate the stereochemistry using wedged/dashed bonds as appropriate. **State whether the products are achiral, a racemic mixture, meso or a single enantiomer** (no explanation needed)

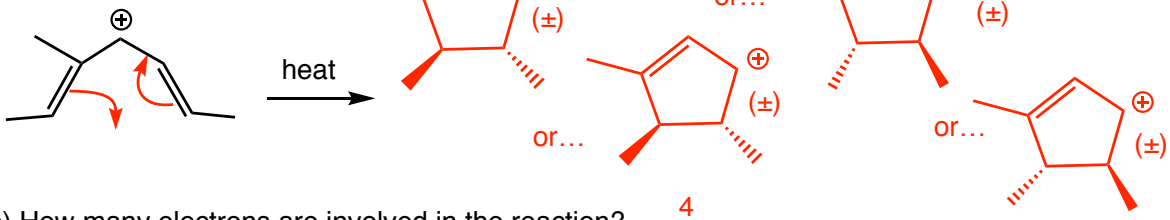
a)  EtOH/HCl (cat.)  single enantiomer

b)  1. MCPBA 2. $Na^+ {}^-OEt$/EtOH  (±) racemic mixture

c)  +  heat  (±) racemic mixture

Question 4 (22 pts)

a) Give the curved arrow-pushing and the allowed product for the following electrocyclic ring closure reaction, indicate whether the product would be achiral, a meso compound or a racemic mixture



b) How many electrons are involved in the reaction? 4

c) Does the allowed reaction proceed via a Huckel or a Mobius transition state? Mobius

d) Does the allowed reaction proceed via a conrotatory or disrotatory ring opening? conrotatory

e) If you said that the reaction proceeds via a Huckel transition state then VERY BRIEFLY explain why it doesn't go via a Mobius transition state, or if you said Mobius then why not Huckel? Your explanation should include the terms "aromatic" or "anti-aromatic" as appropriate

this is a 4 electron reaction, 4 electrons in a Huckel transition state would be anti-aromatic

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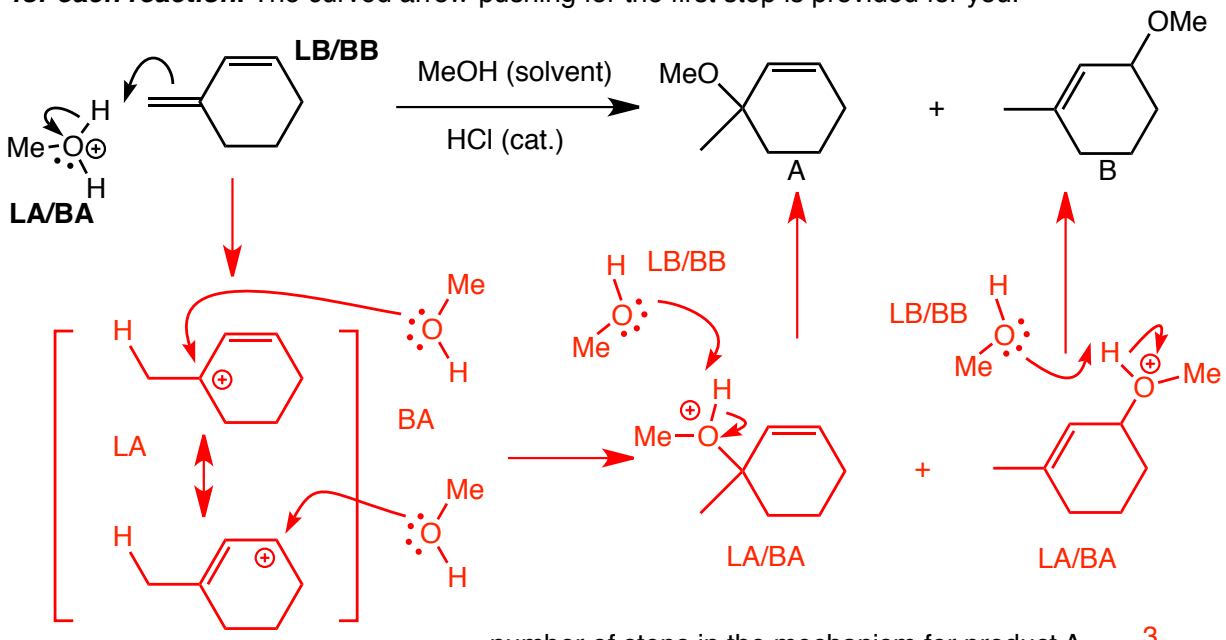
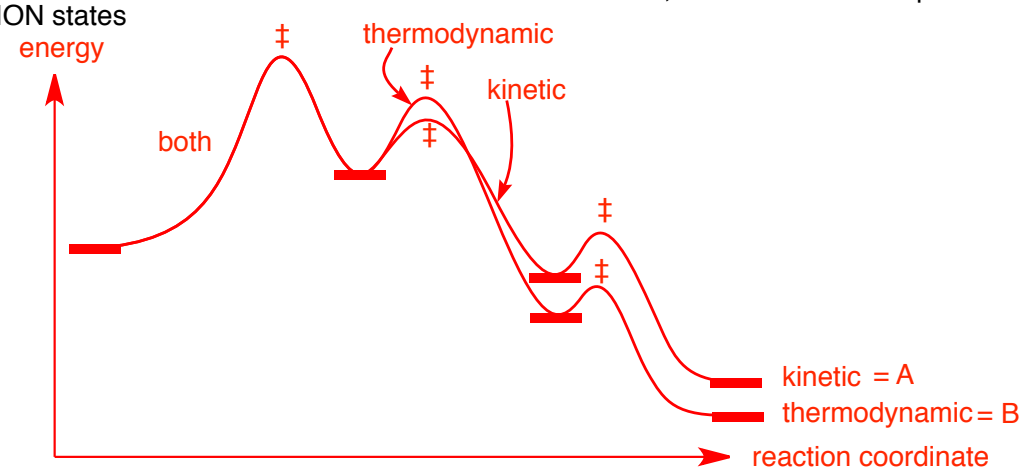
Question 5a (20 pts.) For the following reaction, give a full curved-arrow pushing mechanism for formation of BOTH products and **indicate the Lewis acid and base at each step (LA or LB) and whether they are also Bronsted acids and bases (BA or BB), i*nclude all important resonance contributors for any intermediates and give the number of STEPS for each reaction*.** The curved arrow-pushing for the first step is provided for you.



number of steps in the mechanism for product A 3

number of steps in the mechanism for product B 3

Question 5b (18 pts.) Draw a reaction energy diagram for formation of BOTH of these products on the same diagram, you do not have to include any structures on your diagrams, but CLEARLY INDICATE WHICH DIAGRAM REFERS TO WHICH REACTION, and INDICATE the positions of all TRANSITION states



c) Briefly explain which product is more likely to be formed under conditions of kinetic and thermodynamic control, and why

kinetic = A, thermodynamic = B, B is more likely to be formed at HIGH temperature since higher temperature enables **REVERSIBLE** reactions and allows the reaction to explore the entire reaction energy surface and find the lowest energy product

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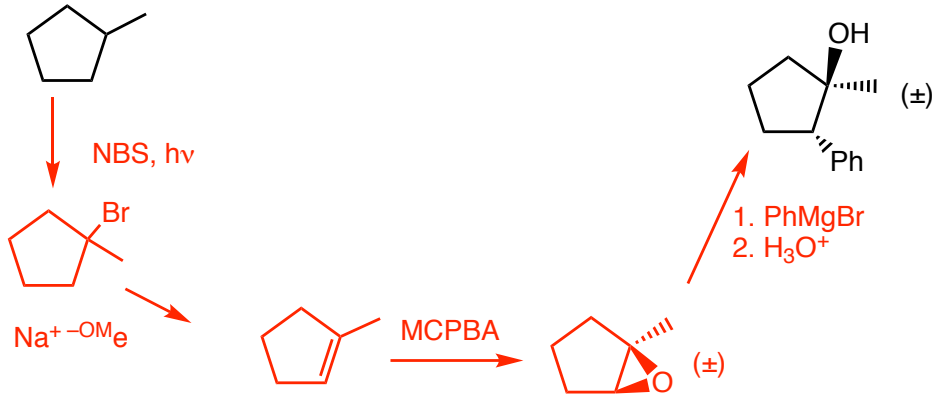
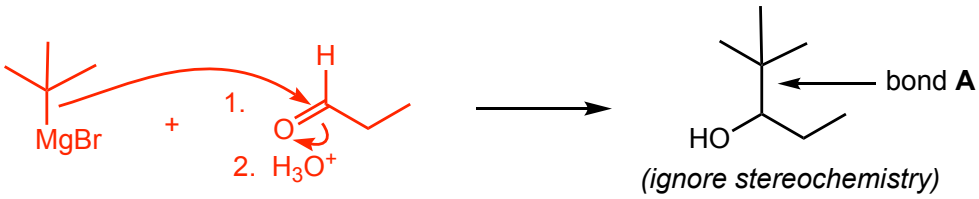
Question 6 (20 pts.) Show how you would make the target compounds on the right from the starting compounds on the left. Show reagents and conditions where appropriate, and the structures of important intermediate compounds. Do not show any (arrow pushing) mechanisms.



Question 7 (14 pts.) For the provided structure, show how you would make the bond **A** in a Grignard reaction, give the Grignard reagent, what it would react with and any other reagents/ conditions



(ignore stereochemistry)

 NAME _____

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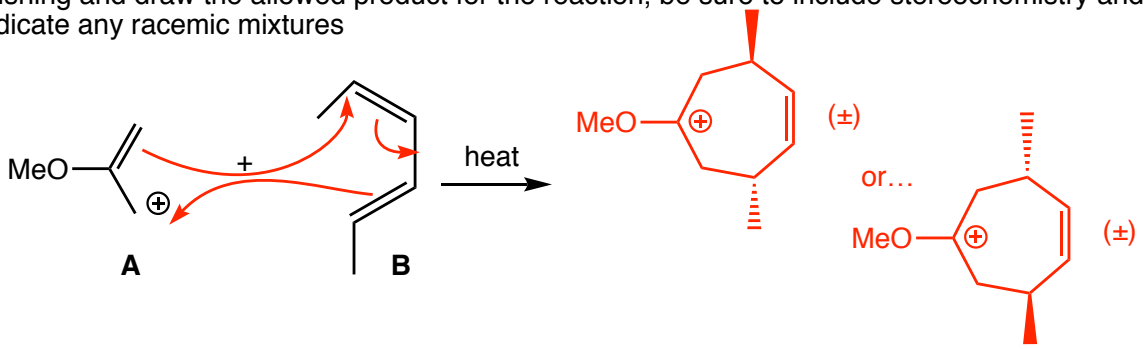
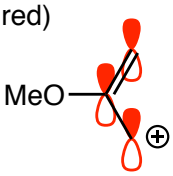
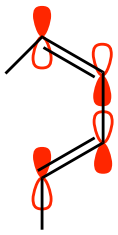
Question 8a (10 pts.) For the cycloaddition reaction shown below, give the curved arrow-pushing and draw the allowed product for the reaction, be sure to include stereochemistry and indicate any racemic mixtures



Question 8b (4 pts.) On TOP of the reactant structure **A** below, draw a pictorial representation of the HOMO (draw it on the structure below rather than the one in the equation so that the curved arrow-pushing isn't obscured)



Question 8c (4 pts.) on TOP of the reactant structure **B** below, draw a pictorial representation of the LUMO (draw it on the structure below rather than the one in the equation so that the curved arrow-pushing isn't obscured)



Question 8d (2 pts.) Is the allowed reaction suprafacial or antarafacial for reactant **A**?

suprafacial

Question 8d (2 pts.) Is the allowed reaction suprafacial or antarafacial for reactant **B**?

suprafacial