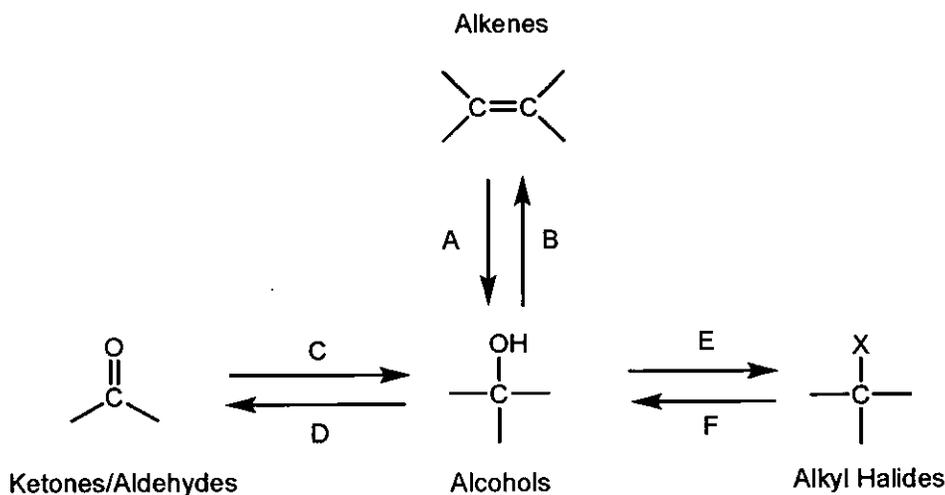


1. Show the reagents to accomplish the general transformations below between alkenes, alcohols, ketones/aldehydes, and alkyl halides. In nearly all of the cases, there are at least two sets of conditions. Show all of the relevant ones

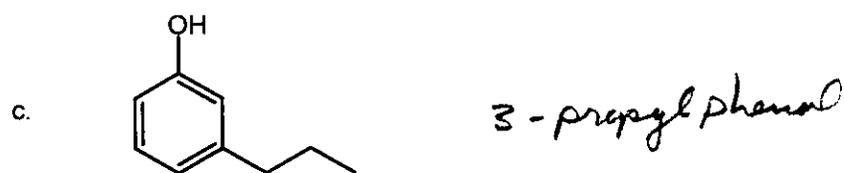
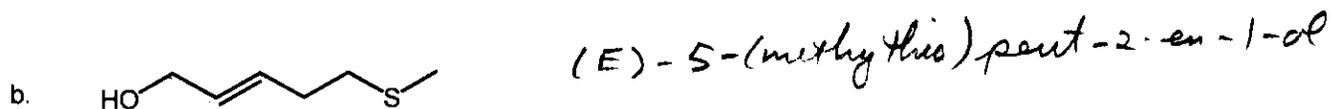
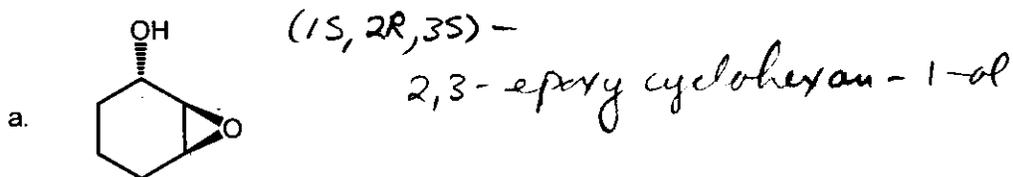
(60 points)



- A 1. $\text{BH}_3 \cdot \text{THF}$ or 1. $\text{Hg}(\text{OAc})_2 \cdot \text{H}_2\text{O}$ or dilute H_2SO_4
2. $\text{H}_2\text{O}_2, \text{OH}^-$ 2. NaBH_4
- B conc. $\text{H}_2\text{SO}_4, \Delta$ or 1. $\text{Ts-Cl}, \text{Py}$ or 1. PBr_3
2. Et_3N 2. Et_3N
- C NaBH_4 or 1. LAH or NADH or H_2, Ni
 CH_3OH 2. H_2O (old fashion)
- D $\text{Na}_2\text{Cr}_2\text{O}_7$ or PCC or NAD^+
 $\text{H}_2\text{SO}_4, \text{H}_2\text{O}$
- E PBr_3 or SOCl_2 or $\text{HBr}, \text{HCl}, \text{HI}$
- F $\text{H}_2\text{O}, \Delta$ for 3° or $^\ominus\text{OH}$ for $1^\circ, 2^\circ$

2. Provide IUPAC names for the following compounds.

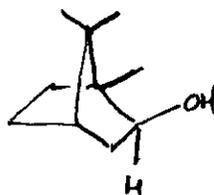
(30 points)



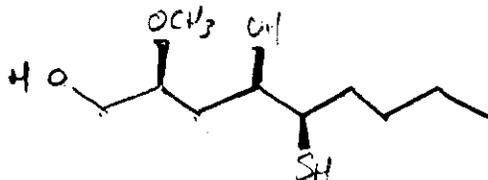
3. Provide structures for the following compounds.

(20 points)

a. (1S,2S,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-ol



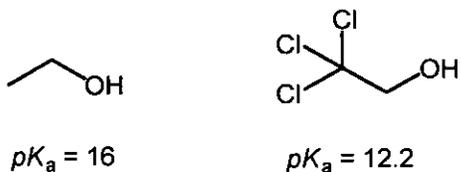
b. (2S,4R,5R)-2-methoxy-5-mercaptononane-1,4-diol



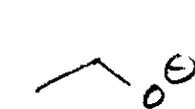
4. Explain the two trends in acidity for the following compounds

(10 points)

Trend 1

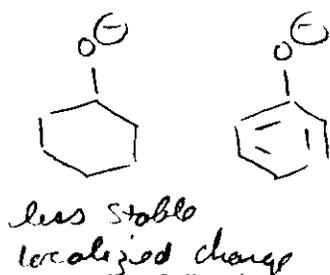
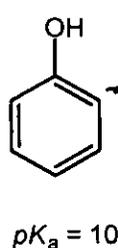


greater acidity means more stable conjugate base



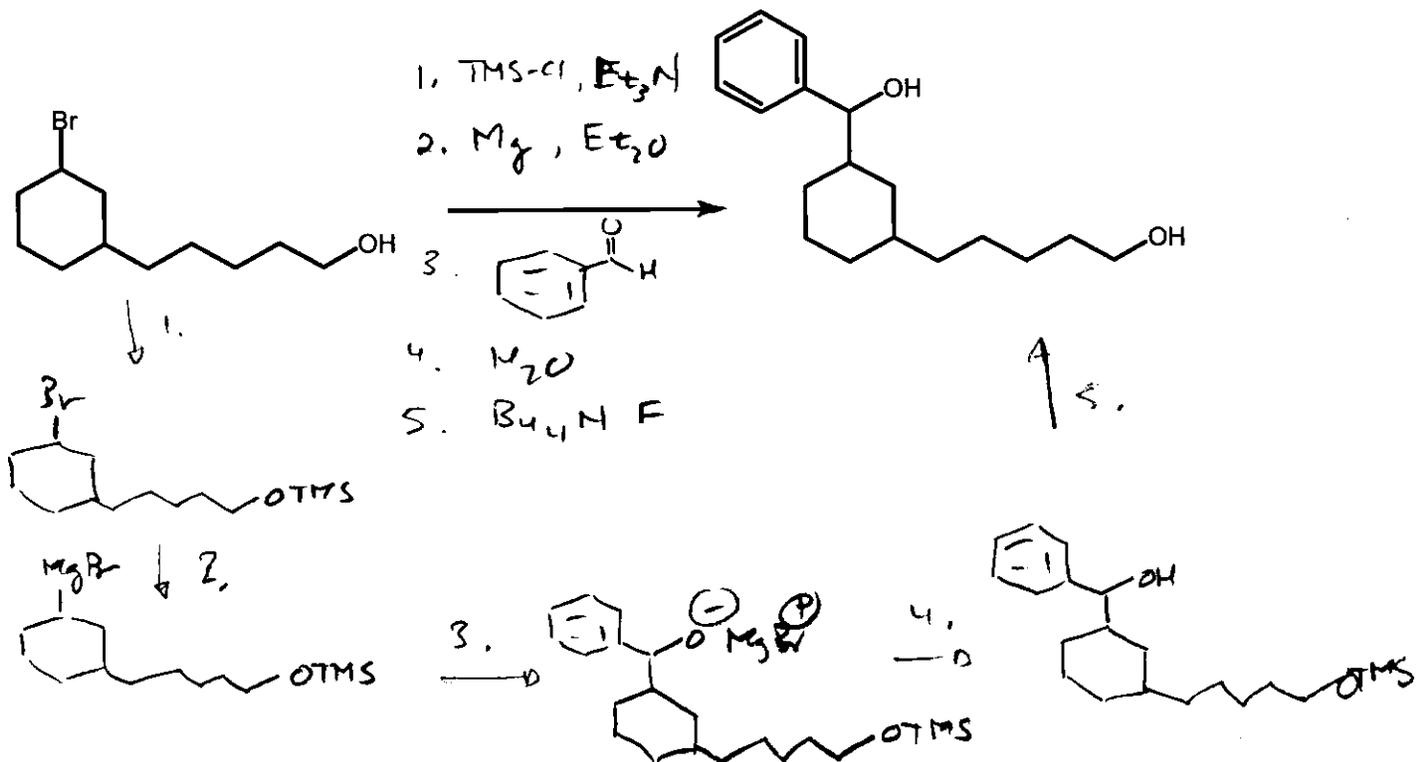
this conjugate base is more stable due to inductive withdrawal of δ^-

Trend 2

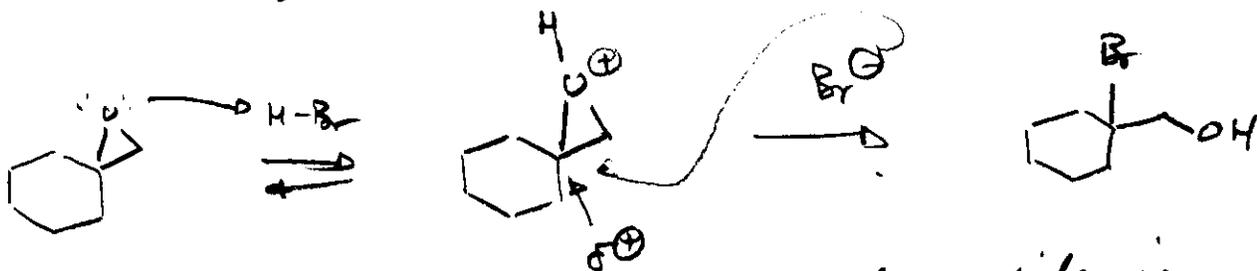
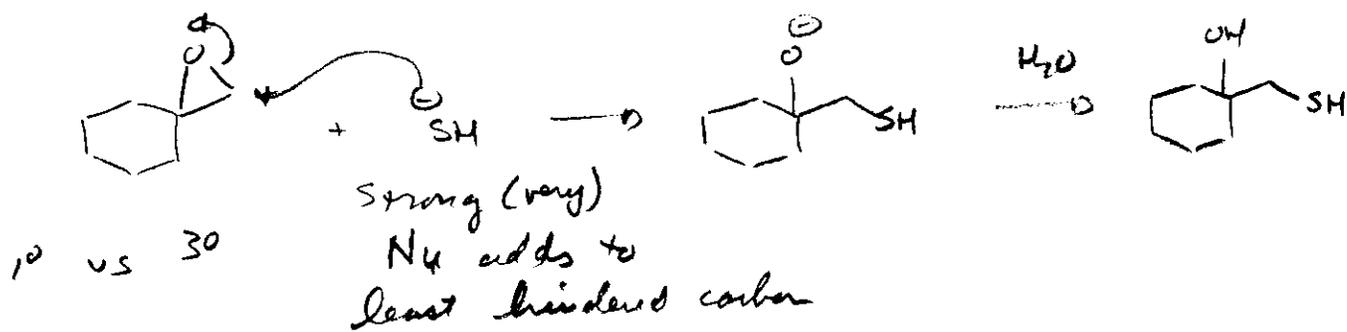
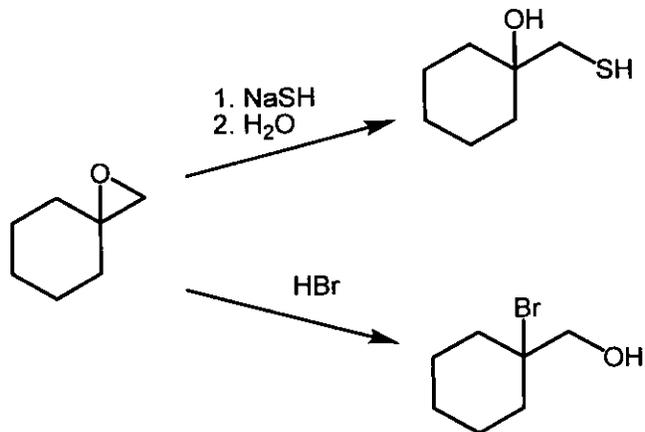


charge is delocalized by resonance, so this conj. base is more stable

5. Show reagents and conditions to accomplish the following – show all intermediates. (10 points)

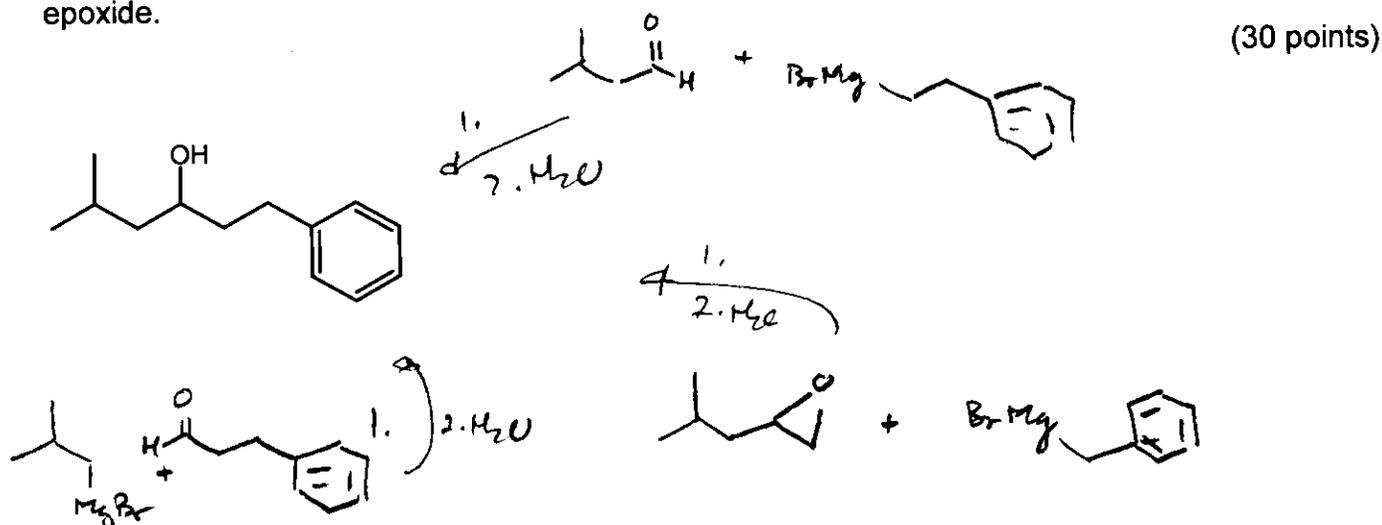


6. In terms of the mechanisms involved, explain why the two reactions below have different selectivities in the opening of the epoxide. (10 points)

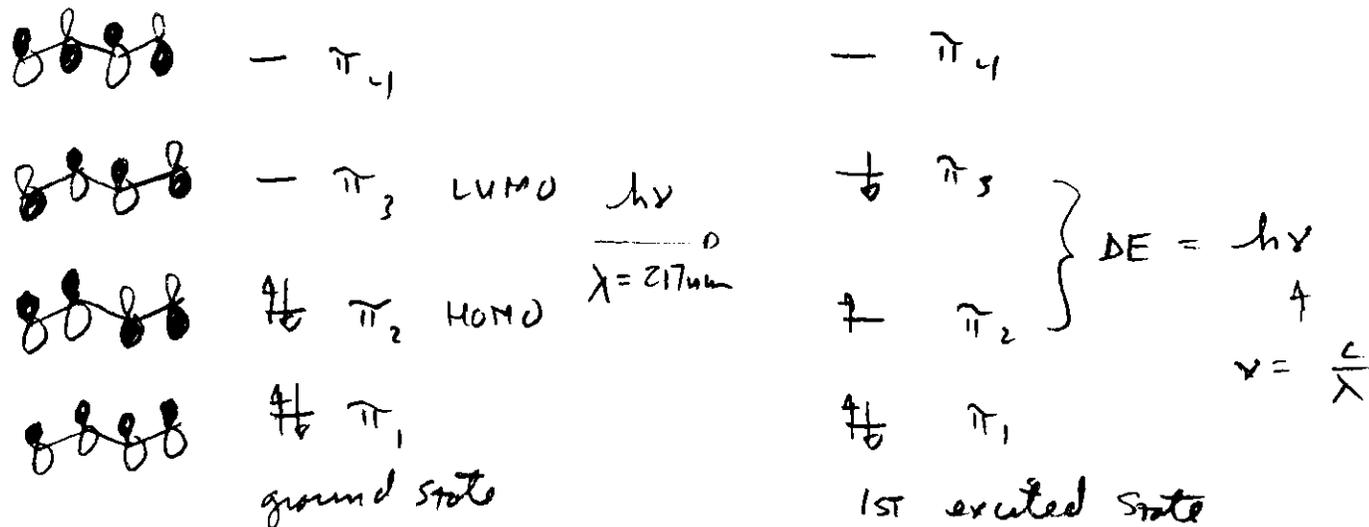


when oxygen of epoxide is protonated, then Nu adds to more substituted carbon - it has the largest δ^+ so is the most reactive center

7. Show how to prepare the following alcohol using a Grignard reagent three (3) different ways. You can use whatever starting materials you like, but one of the methods must involve an epoxide. (30 points)

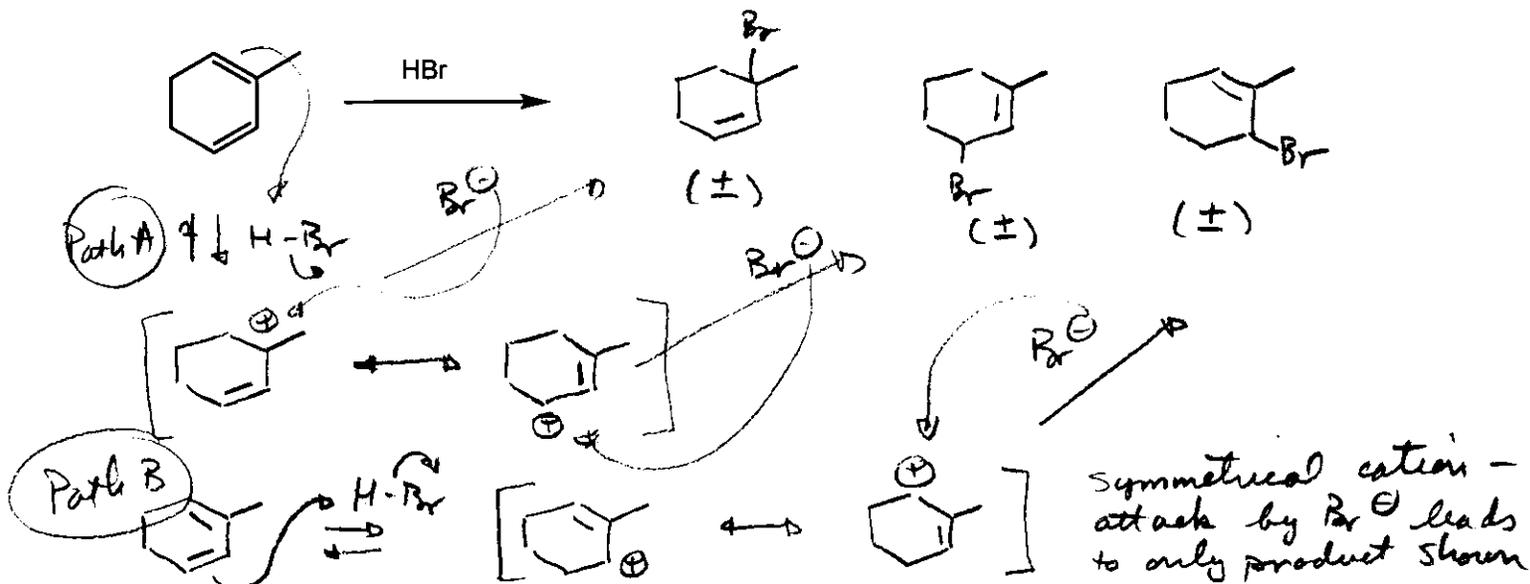


8. Draw the pi molecular orbitals of 1,3-butadiene. Show how these orbitals are filled with electrons in the ground state. Indicate which orbital is the Highest Occupied MO (HOMO) and which is the Lowest Unoccupied MO (LUMO). Finally, describe what happens when 1,3-butadiene absorbs in the UV region at 217 nm. (40 points)



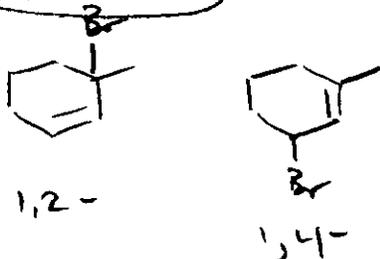
1,3-butadiene absorbs light @ 217nm and forms the 1st excited state - which is an electronic transition

9. Predict the products and propose a mechanism for the following reaction. (10 points)



10. Label the products in Question 9 as either 1,2- or 1,4-addition products and suggest which products might be favored if the reaction were run at low temperatures (0°C) and which might be favored at high temperatures (50°C). (10 points)

From Path A

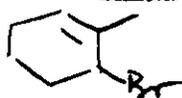


These products are favored at all temperatures since they are formed from a more stable allylic carbocation.

1,2 - favored at cold temp

1,4 - favored at warm temp

From Path B



1,2- & 1,4- are the same product so no way to see temperature dependence.

- is likely a minor product compared to those from Path A.