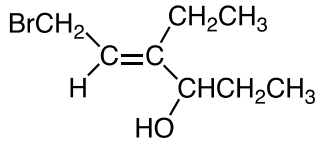
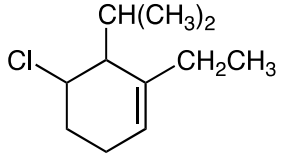
L. I. U.

Chem. 121, Sect 005, Exam II Fall, 2011, 150 points

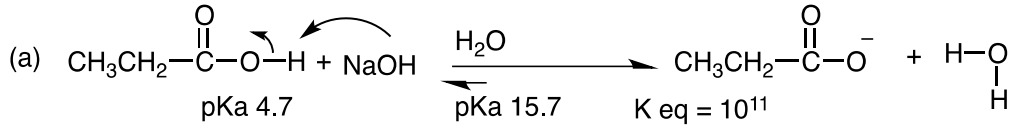
1. Name the following compounds. Be sure to specify E/Z where appropriate. (20 pts)

(a) 

(b) 

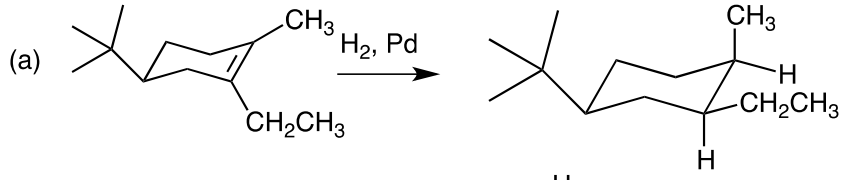
(a) E-6-bromo-4-ethyl-4-hexen-3-ol (b) 4-chloro-2-ethyl-3-isopropylcyclohexene

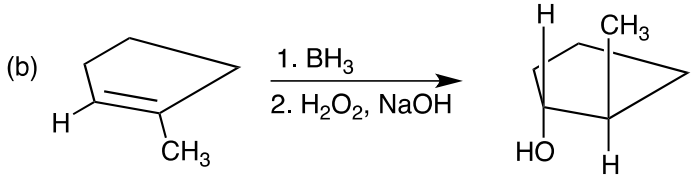
2. Give the products of the following acid-base reactions and in each case calculate the equilibrium constant. (30 pts)

(a) 

(b) 

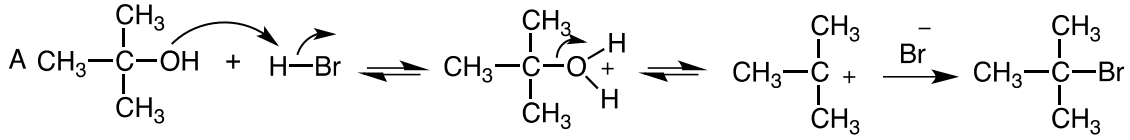
3. Give the products of the following reactions. You do not need to show the complete mechanism but you must show the correct stereochemistry. (20 pts)

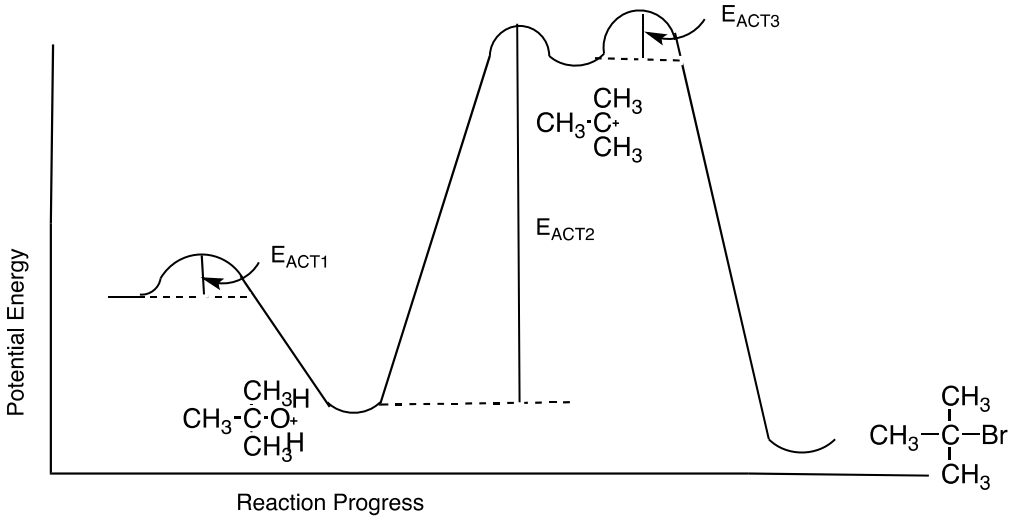
(a) 

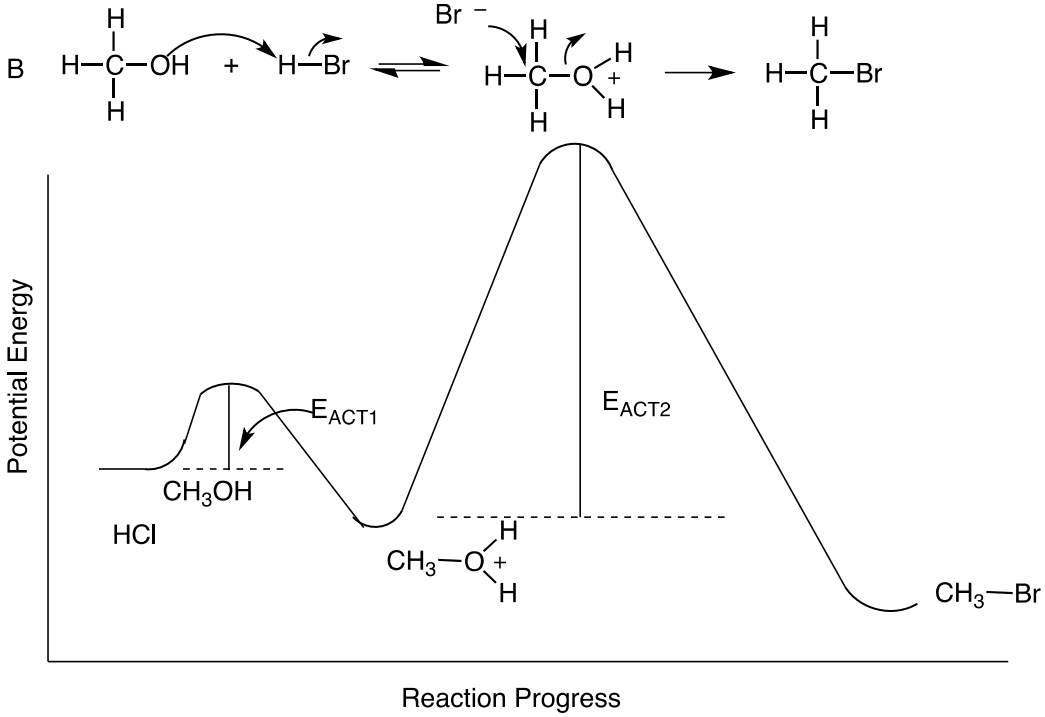
(b) 

4. Which molecule would react faster with HBr? Explain by showing the full reaction mechanism for each molecule and make a careful potential energy versus reaction progress diagram for each reaction. Be sure to point out how the energy diagrams are different. (30 pts)

Molecule **A** reacts faster with HBr since it is an S_N1 reaction and forms a very stable tertiary carbocation.

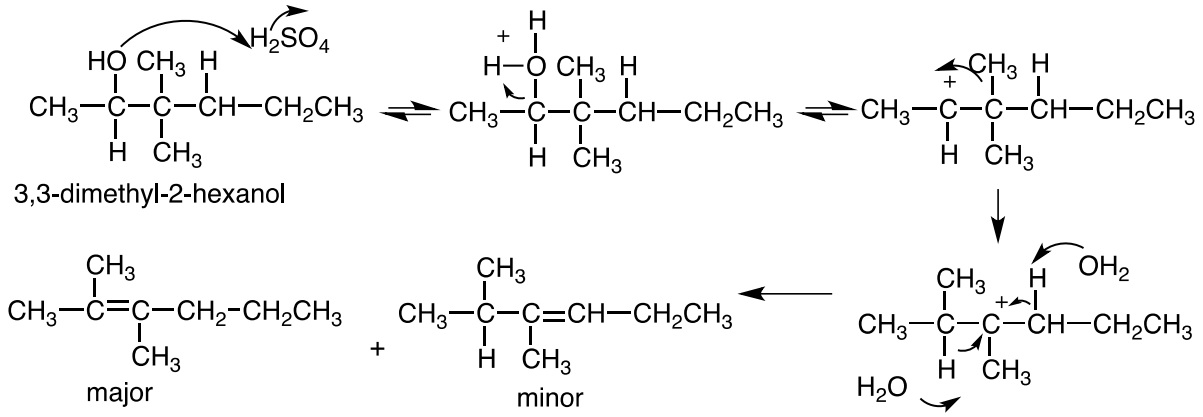






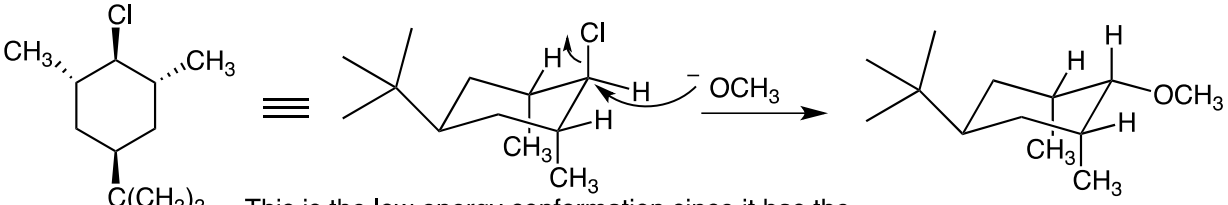
The key point is that the activation energy for the S_N2 process (E_{ACT2})) should be higher than for the S_N1 process.

5. Explain why using 3,3-dimethyl-2-hexanol would not be a good starting material for the synthesis of 3,3-dimethyl-1-hexene. Show the reaction that would occur with H_2SO_4, giving all the individual steps of the reaction mechanism, and giving the actual major and minor products that are formed. (20 pts)
The major product is not the desired 3,3-dimethyl-1-hexene but the product that arises from the initially formed secondary carbocation rearranging to the tertiary carbocation followed by dehydration.



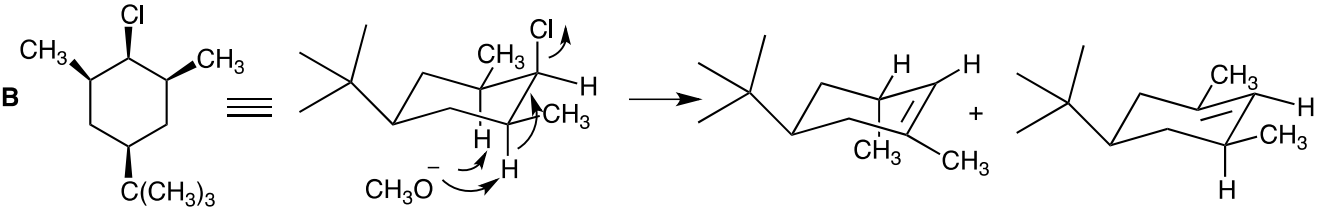
6. Molecule **A** reacts very slowly with sodium methoxide in methanol ($NaOCH_3/HOCH_3$) while molecule **B** reacts rapidly. Explain why by making careful three-dimensional chair drawings of each molecule and showing the reaction that occurs with each one, including the expected product. (30 pts)

A



This is the low energy conformation since it has the large *t*-butyl group in the equatorial position but it cannot eliminate since there are no β–hydrogens. Therefore it will react slowly by an S_N2 mechanism.

B



Reaction is fast because the chlorine is in the correct axial position for elimination to occur and there at two β–hydrogens.