CHEMISTRY 112A FALL 2016

Answer key.

EXAM 2

OCTOBER 20, 2016

NAME- WRITE BIG _____

STUDENT ID: _____

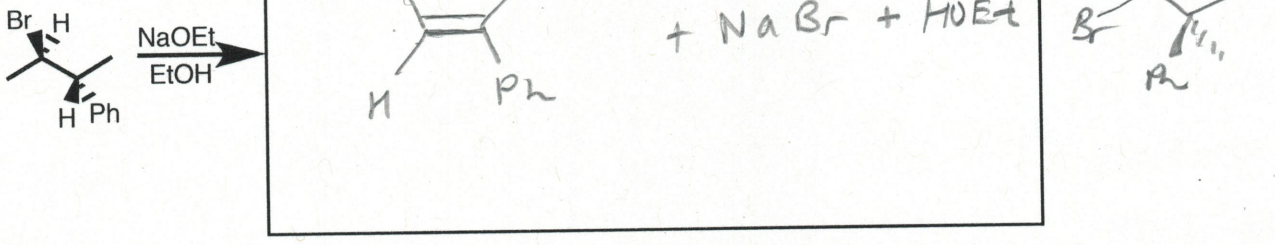
SECTION AND/OR GSI IF YOU ARE IN THE LABORATORY COURSE: _____

- **You will have 75 minutes in which to work.**
- **BE NEAT! Non-legible structure drawings will not be graded.**
- **Only answers in the answer boxes will be graded – you can write in other places, but we only grade the answers in the boxes.**
- **All pages of the exam must be turned in.**
- **No calculators**
- **No stencils**
- **Molecular models may be used**

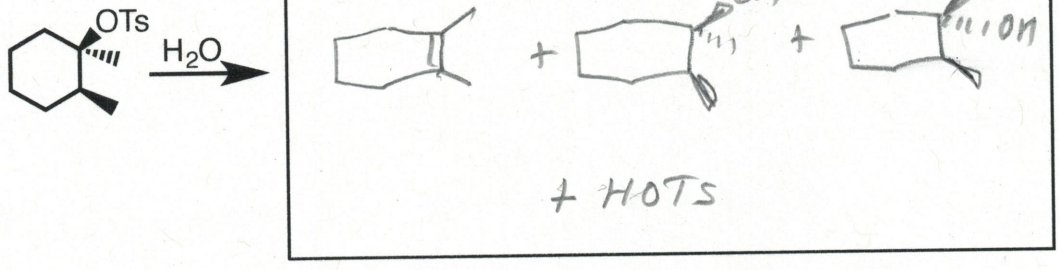
Problem	Points (Maximum)
1	20
2	20
3	16
4	18
5	10
6	17
7	19
Total	*120*

1. (20 points) For each reaction draw the major organic products, **including all stereoisomers**. Write NR if you think there will be no reaction.

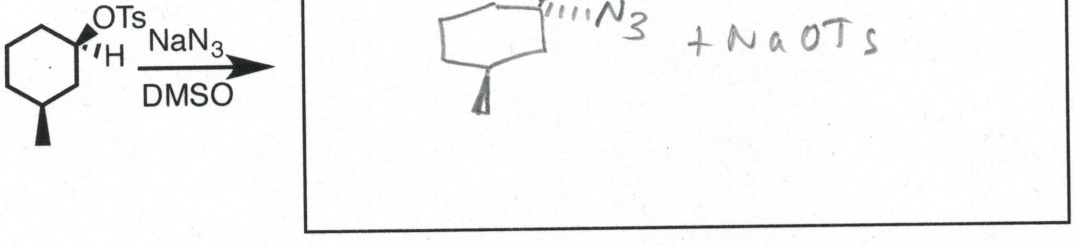
a.



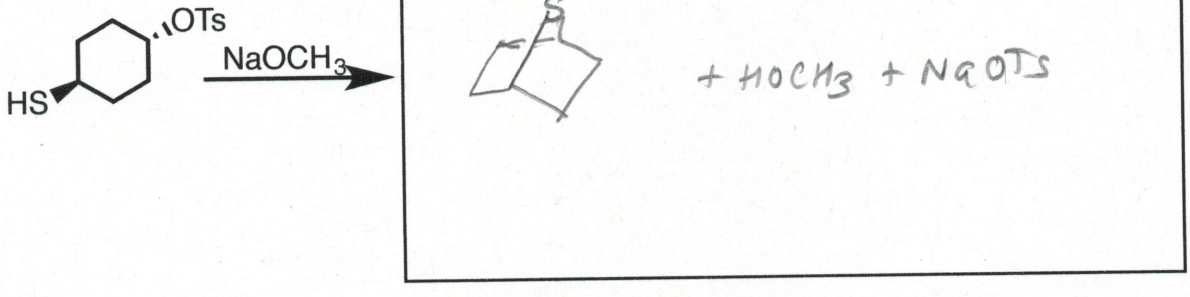
b.



c.

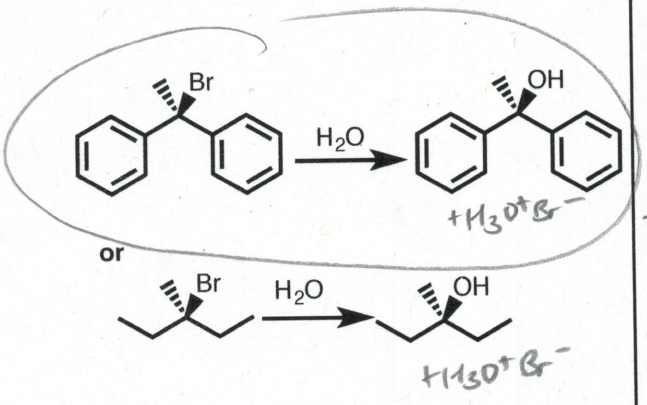


d.



2. (20 points) Circle the reaction in the following pairs of reactions that you would expect to go faster. It is possible that both reactions have the same rate. It is possible that one of the reactions shown in each pair does not occur at a measurable rate. You may disregard any other products besides the ones pictured that may form under the reaction conditions. Give explanations in the boxes provided.

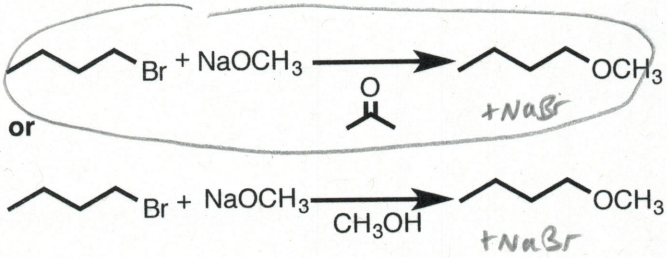
a.



Type of mechanism: SN1
Explanation
Intermediate carbocation stabilized by resonance.

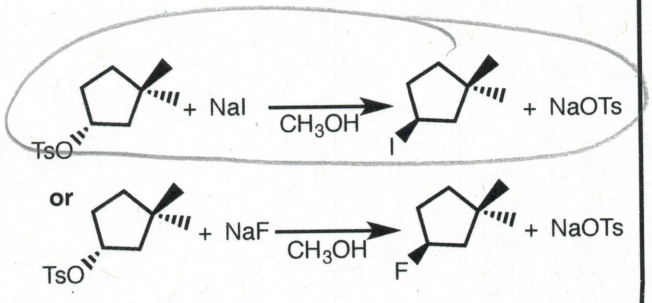
Transition state resembles carbocation so more stable carbocation will have more stable transition state. Starting material stability not affected by resonance. Therefore, top rxn is faster.

b.



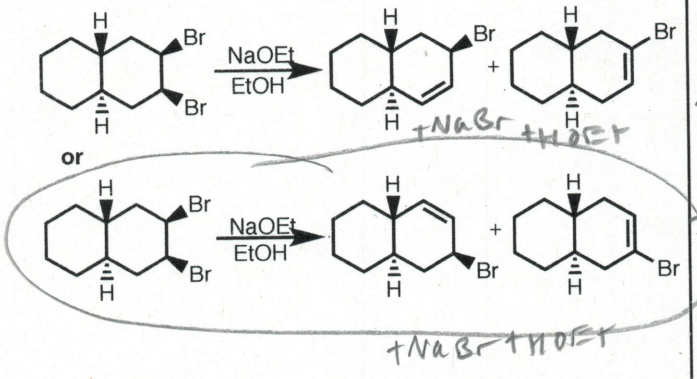
Type of mechanism: SN2
Explanation
SN2 w/ anionic nucleophile is faster in polar aprotic solvent. Protic solvent stabilizes nucleophile, but stabilizes the T.S. less because T.S. has less localized charge. As a result rxn is slower in a polar protic solvent.

c.

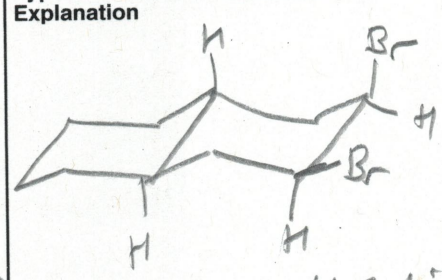


Type of mechanism: SN2
Explanation
I^- is a better nucleophile in polar protic solvent than F^- because F^- is more solvated because it is more basic w/ more localized charge. Solvent molecules have to dissociate for reaction to occur.

d.

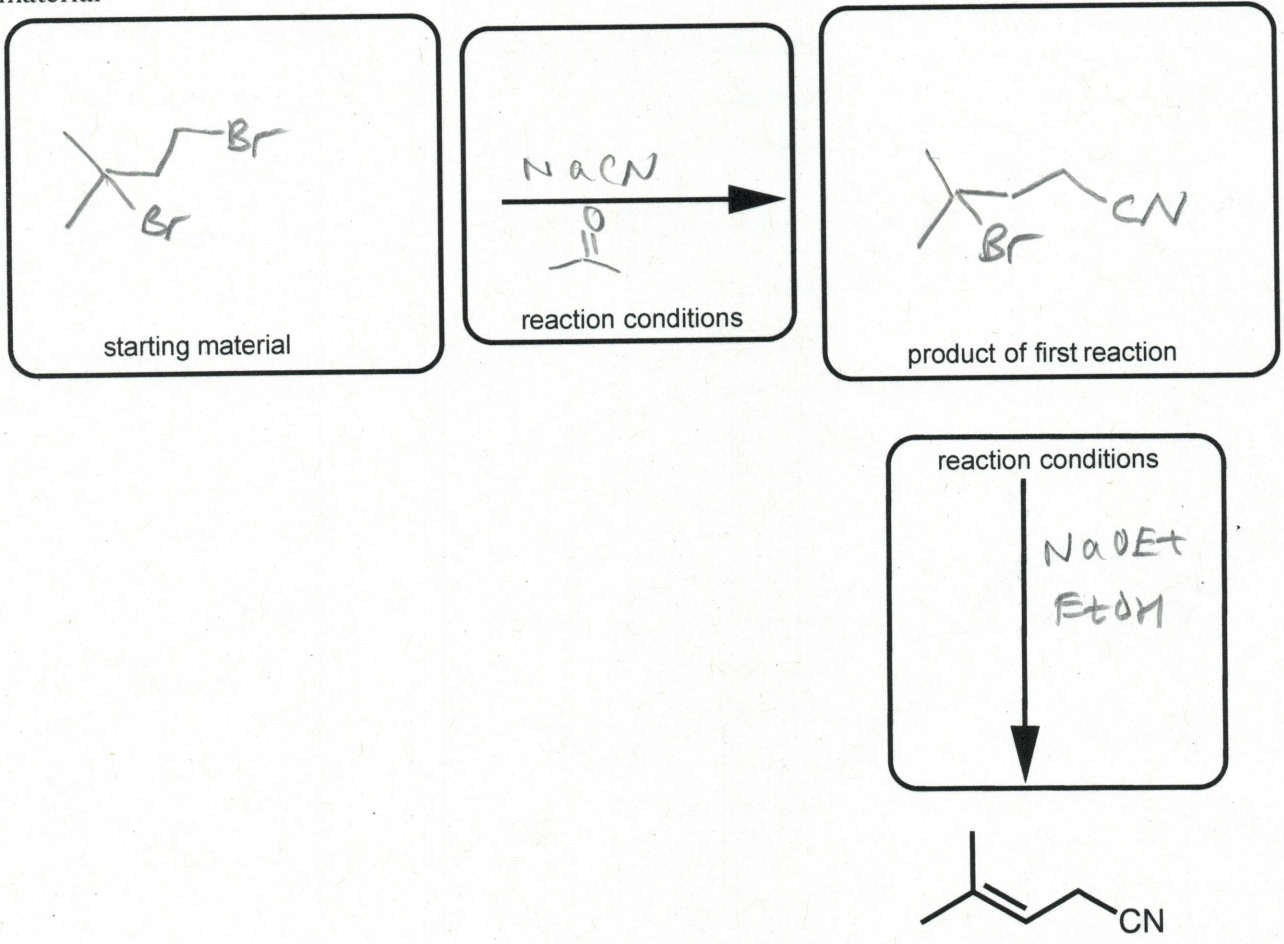


Type of mechanism: E2
Explanation



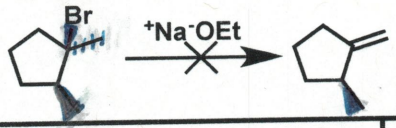
There are no H anti to equatorial Br. Trans decalin cannot ring flip, so the equatorial Br is much less reactive to E2 than axial Br.

3. (16 points) Propose two-step synthesis of the following molecule from any 5-carbon dihalide starting material

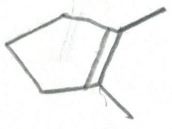


4. (18 points) The following reactions would not occur as written. i. What product would actually be made? ii. Why was the desired product not formed? iii. How could you change either the substrate or reaction conditions to give the desired product?

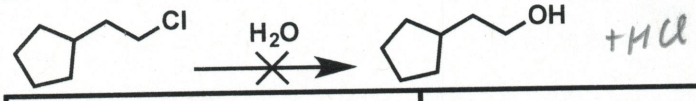
a.



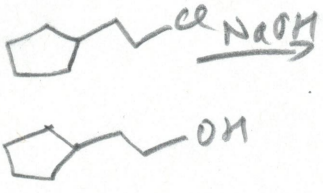
+NaBr

What product is actually made? (Draw structure or NR for no reaction)	Why was desired product not formed? (Explain in 1 sentence)	How could substrate or reaction be changed to give desired product?
	E2 produces more substituted alkene as major product because it is the most stable alkene	Use 

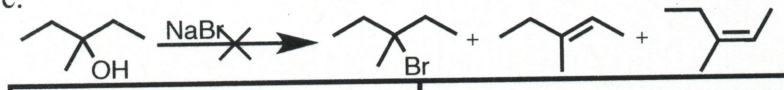
b.



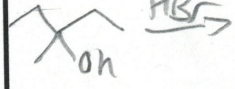
+HCl

What product is actually made? (Draw structure or NR for no reaction)	Why was desired product not formed? (Explain in 1 sentence)	How could substrate or reaction be changed to give desired product?
NR	1° carbocation doesn't form no SN1 or E1 No strong nucleophile or base so no SN2 or E2	

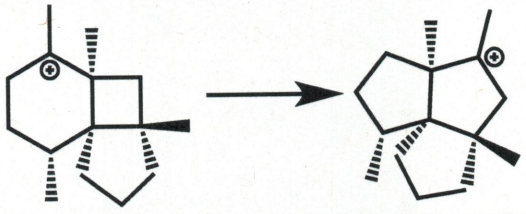
c.



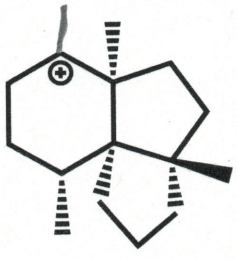
+NaOH

What product is actually made? (Draw structure or NR for no reaction)	Why was desired product not formed? (Explain in 1 sentence)	How could substrate or reaction be changed to give desired product?
NR	No leaving group	 Protonate alcohol to make a good L.G.

5. (10 points) a. Draw the mechanism of the following reaction using arrows to indicate the flow of electrons. Make sure to clearly indicate stereochemistry.

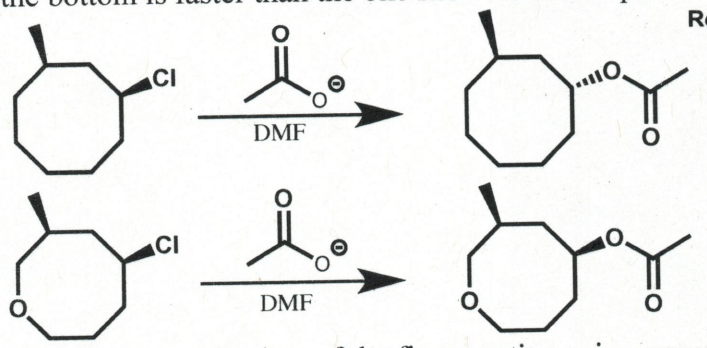


b. Explain why the molecule shown below does not undergo a similar rearrangement.



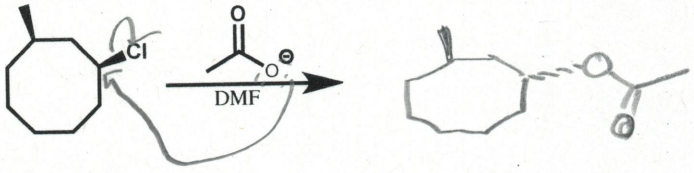
Previous molecule had a lot of ring strain that was relieved by rearrangement. This molecule is not as strained.

6. (17 points) The two reactions shown below have considerably different rates. The reaction shown on the bottom is faster than the one shown on the top.

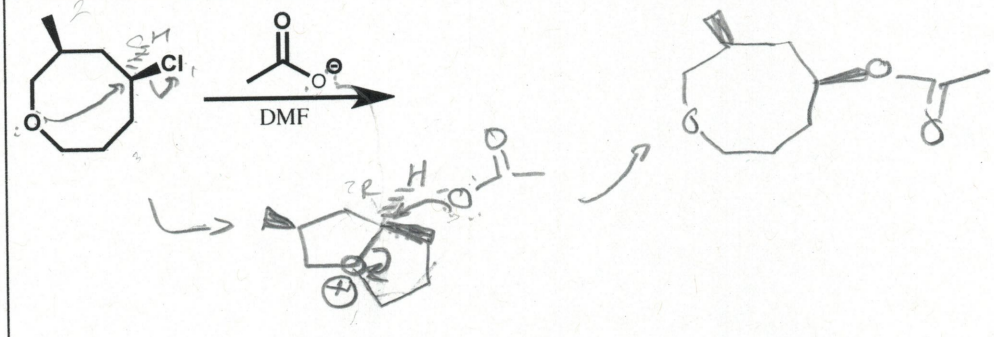


Relative Rate
1
48500

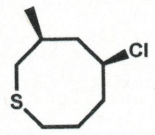
a. Draw the mechanism of the first reaction using arrows to show the flow of electrons.



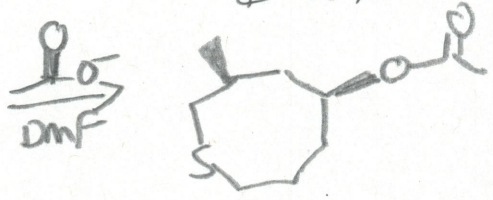
b. Draw the mechanism of the second reaction using arrows to show the flow of electrons.



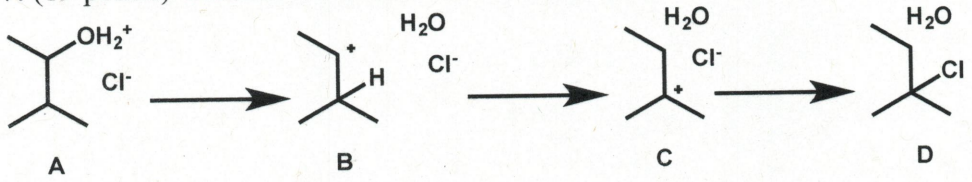
c. Would you expect the reaction with the following starting material to be faster or slower than the two reactions at the beginning of the problem? Explain your answer. Draw Product



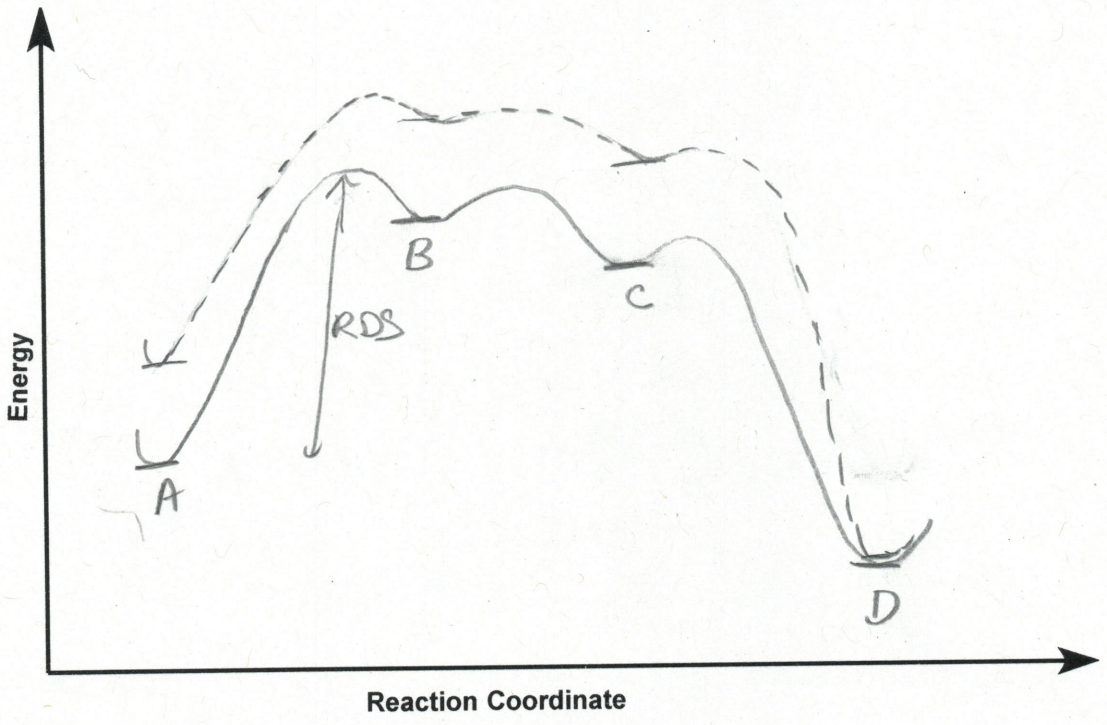
Reaction would be faster because S^- is both a better nucleophile & a better leaving group.



7. (19 points) Consider the reaction shown below.



a. Draw an energy diagram including the relative energies of the reaction above **using the letters shown below each compound.**



b. Label the rate-determining step of the reaction in the diagram you drew in part A.

c. Draw a dotted line on your energy diagram showing how the energies will change if run in a polar aprotic solvent

d. If the reaction is run in a polar aprotic solvent, is the reaction expected to speed up, slow down, or not change? Explain your answer.

Starting materials & intermediat carbocations are all charged & will be destabilized by polar aprotic solvent. The charge is more distributed in the Transition State so the T.S. should be less destabilized by polar aprotic solvent. As a result the reaction should be faster in a polar aprotic solvent.