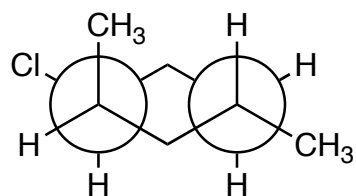
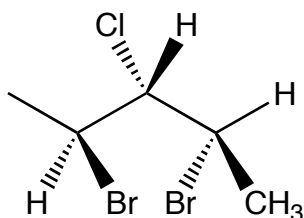


- 1) Provide an unambiguous name for each of the following structures and indicate whether each is chiral or achiral. Be sure to indicate stereochemistry in the name where appropriate. (14 points)



Chiral or Achiral (circle one)

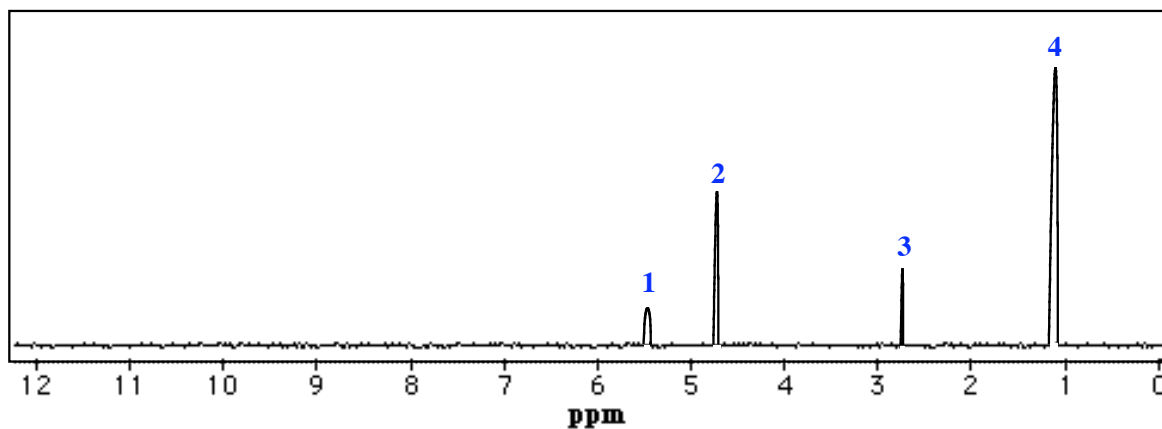
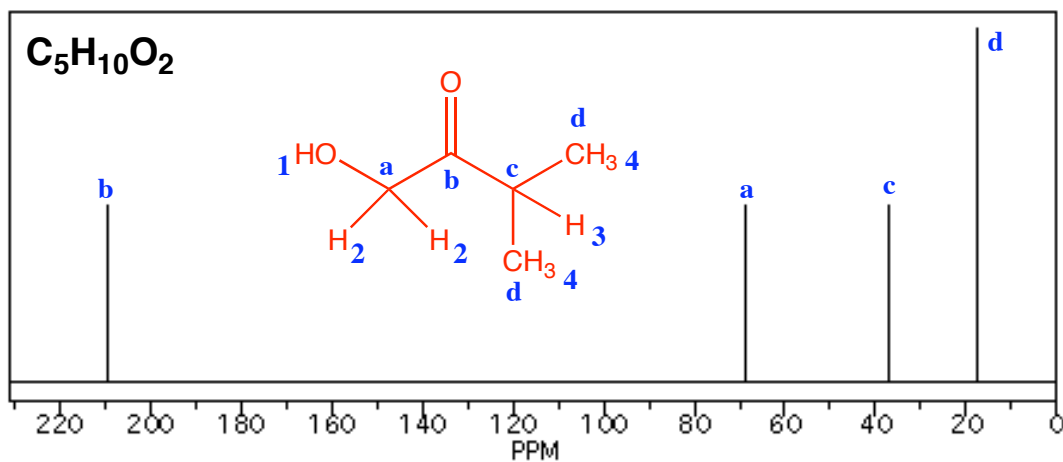
**(1S,2R,4S)-1-chloro-2,4-dimethylcyclohexane**



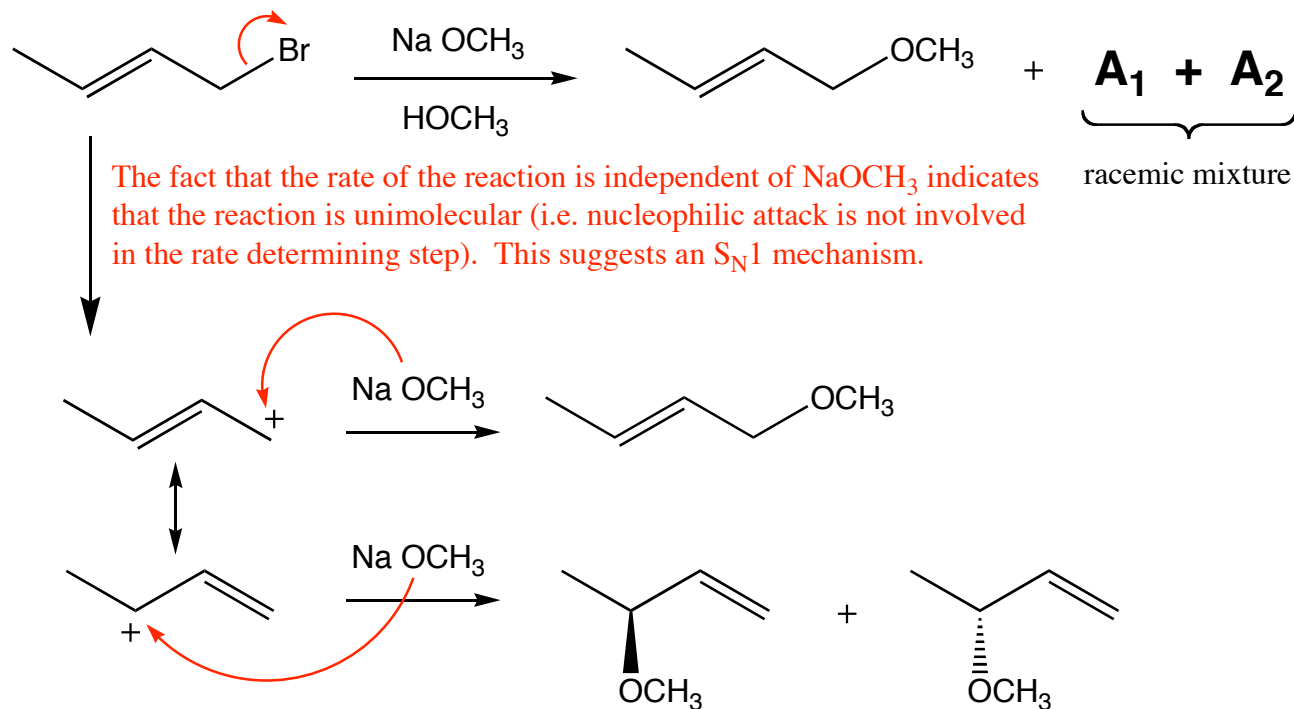
Chiral or Achiral (circle one)

**(2S,4R)-2,4-dibromo-3-chloropentane**

- 2) Determine the structure of the compound that produces the following spectra. For full credit, assign all peaks in each spectrum. Show your work for partial credit. (12 points)

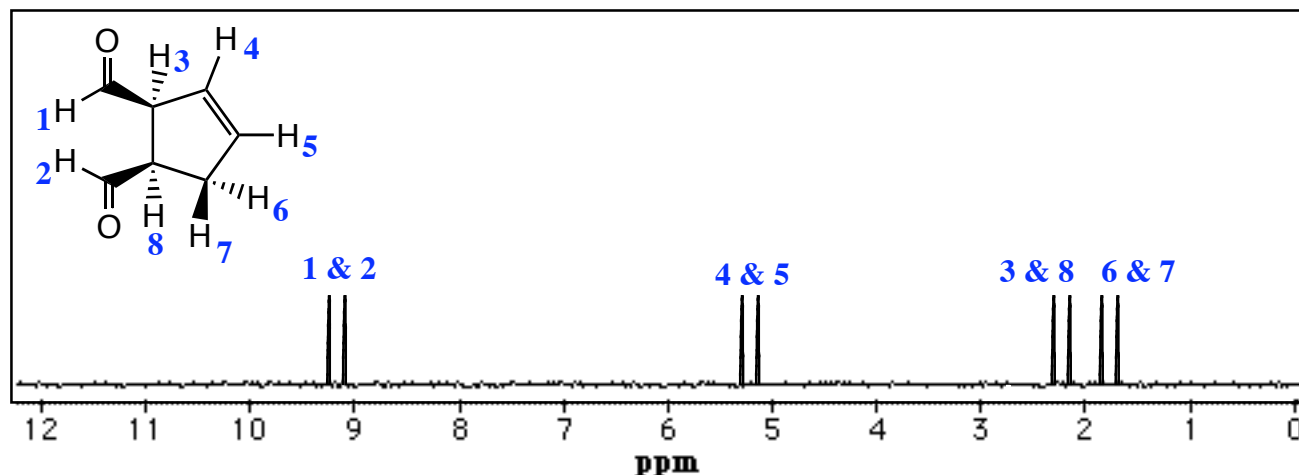


- 3) The substrate below undergoes a substitution reaction to yield the ether shown & the products  $A_1$  &  $A_2$  ( $A_1$  &  $A_2$  constitute a racemic mixture). The rate of the reaction was also shown to be *independent* of  $\text{NaOCH}_3$  concentration. Draw the structures of  $A_1$  &  $A_2$  and *provide a mechanism* that explains the formation of all products. Show all charges & intermediates where applicable. (12 points)

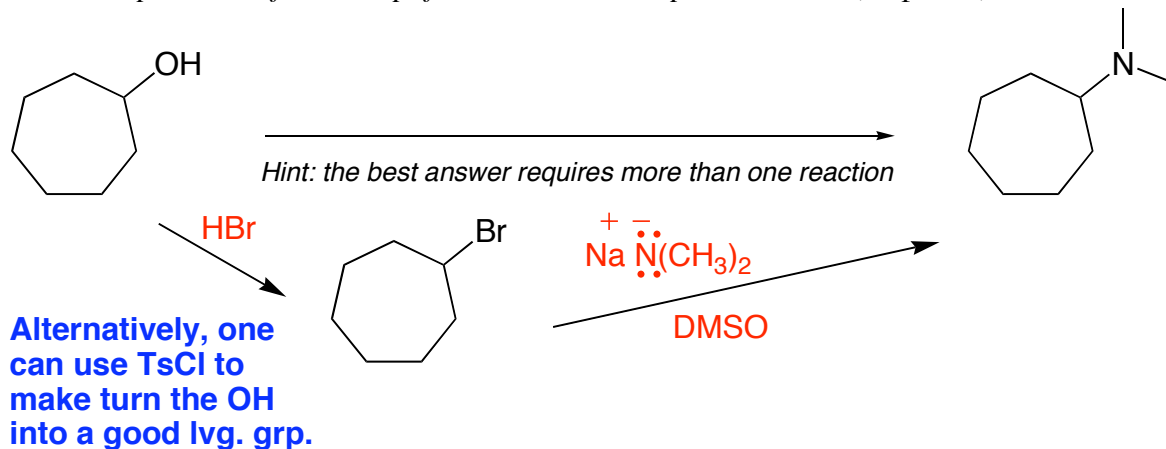


Although this is a  $1^\circ$  carbocation, it is stabilized by charge delocalization thru resonance.

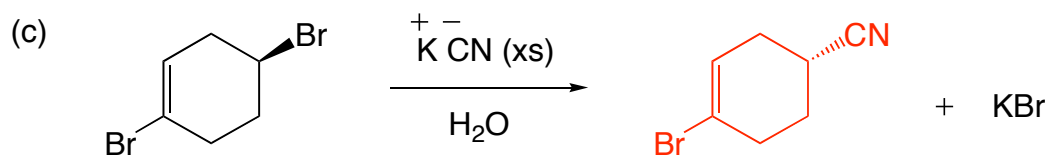
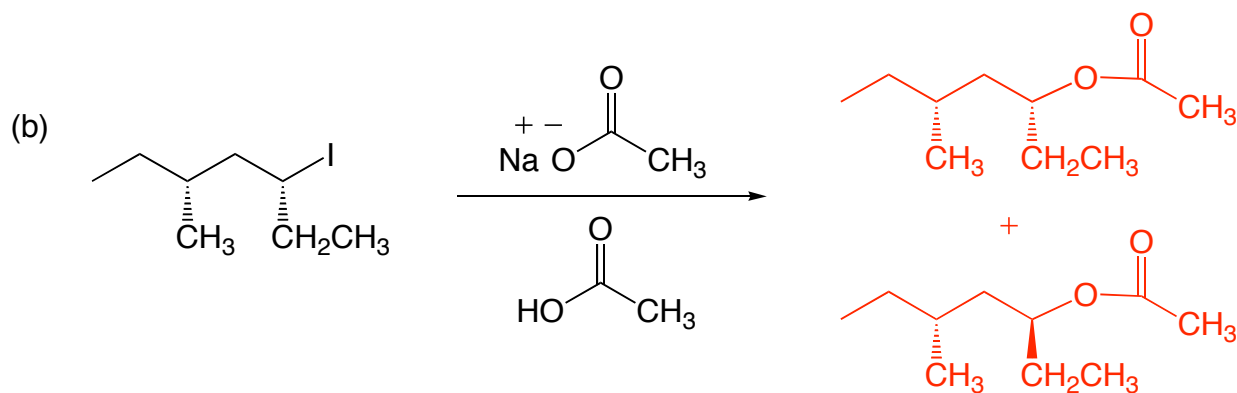
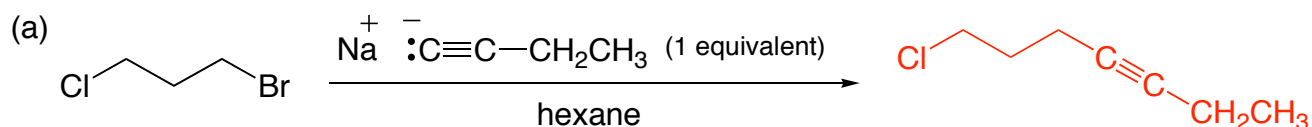
- 4) Predict the  $^1\text{H}$  NMR of the compound shown by drawing the peaks onto the blank spectrum. Assign all peaks for full credit. *Hint: draw in all of the hydrogens before proceeding.* (12 points)



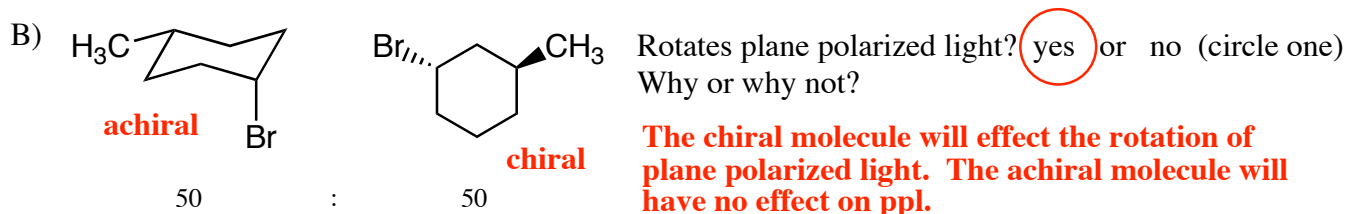
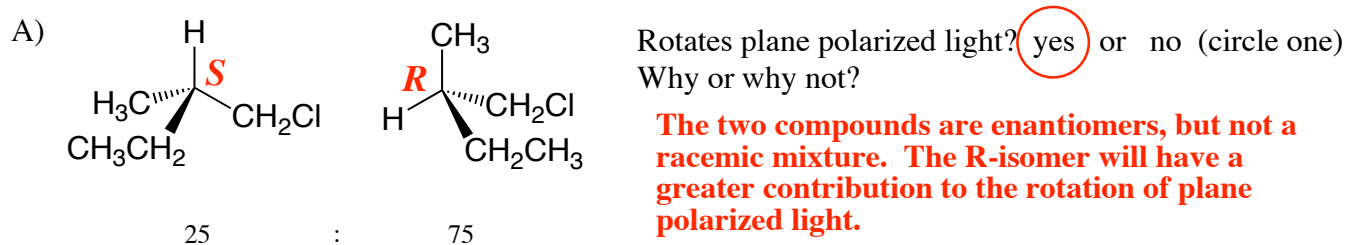
- 5) Propose a synthesis (sequence of reactions) that will accomplish the following transformation. *Be sure to include the products of each step if more than one step is involved.* (10 points)



- 6) Draw and circle the **major product** of each of the following reactions. *Be sure to include stereochemistry in your answers where appropriate.* (18 points)



7) Determine whether the following mixture of molecules will rotate plane polarized light. Show your work and provide a brief explanation for your decision. (12 points)



8) The substrates shown below can undergo an intramolecular  $S_N2$  reaction as indicated below. One reaction occurs much faster than the other. Draw the product for the faster reaction and provide an explanation for your decision using pictures and words. *Note:  $Na^+$  is a spectator ion.* (10 points)

