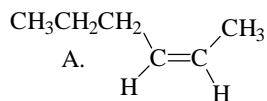
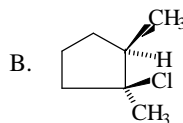


Exam # 2
Chemistry 2401 – October 24, 2003

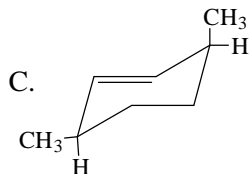
(16) I. Name each of the following. In each case include the stereochemical designation.



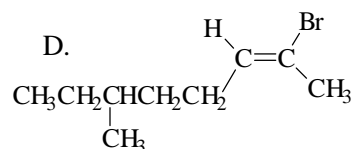
cis-2-hexene



trans-1-chloro-1,2-dimethylcyclopentane



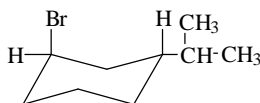
cis-3,6-dimethylcyclohexene



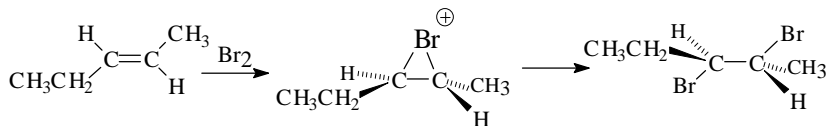
E-2-bromo-6-methyl-2-octene

(16) II. Draw structural formulas for each of the following.

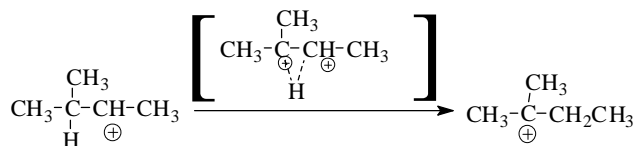
A. The lower energy conformation of *trans*-1-bromo-3-isopropylcyclohexane



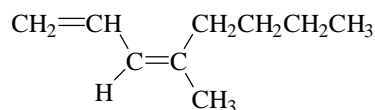
B. The intermediate for the reaction shown below.



C. The transition state for the reaction step shown below:



D. Z-4-methyl-1,3-octadiene



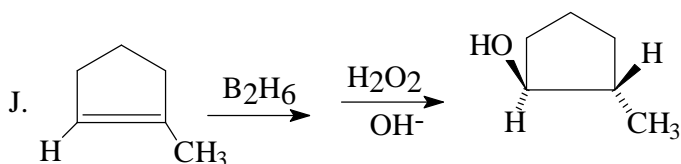
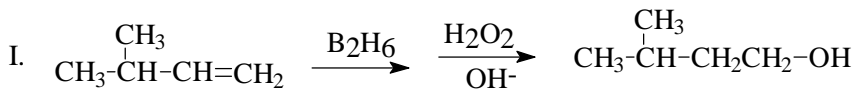
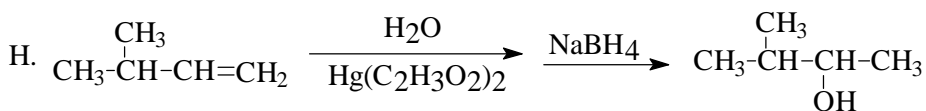
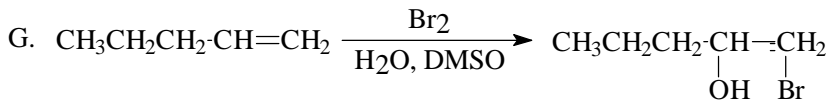
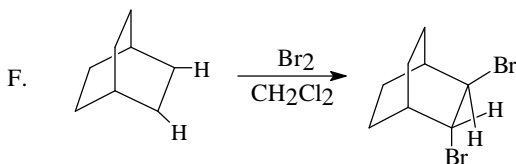
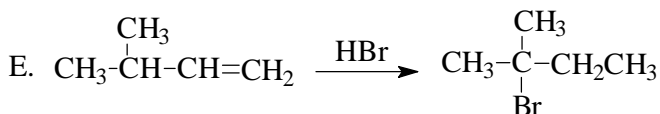
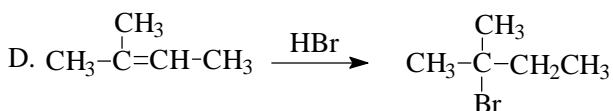
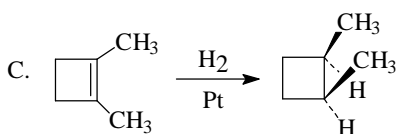
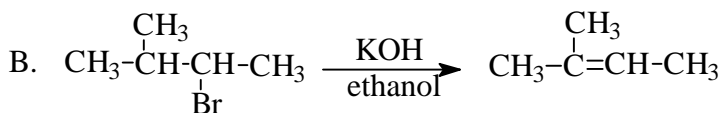
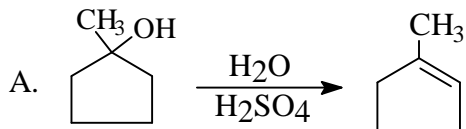
(6) III. If 2.35 mmoles of a compound with a molecular formula of $C_{12}H_{20}O_2$ reacts with 4.75 mmoles of H_2 , then

___3___ A. How many degrees of unsaturation does it possess?

___2___ B. How many double bonds does it contain?

___1___ C. How many rings does it have?

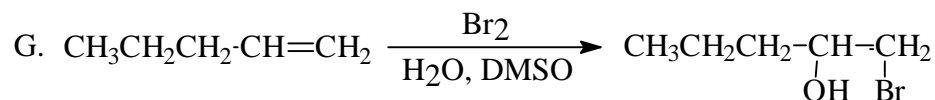
(40) IV. Complete each of the following reactions by drawing a structural formula for the product. If more than one product is formed, draw the structure of only the one formed in largest amount. In cases where it is appropriate your structure should display the proper stereochemistry of the product.



(4) V. You have been given a solid compound to identify and have been told that it is either compound A or compound B, bottles of which are both in the storeroom. Explain how you would use mixture melting points to tell whether the unknown solid is either A or B.

Prepare mixtures of the unknown with compound A and also with compound B. Take the melting point of each mixture along with a sample of the unknown. The mixture with compound that is identical to the unknown will melt at the same time as the unknown itself. The other mixture will melt at a lower temperature than the pure unknown.

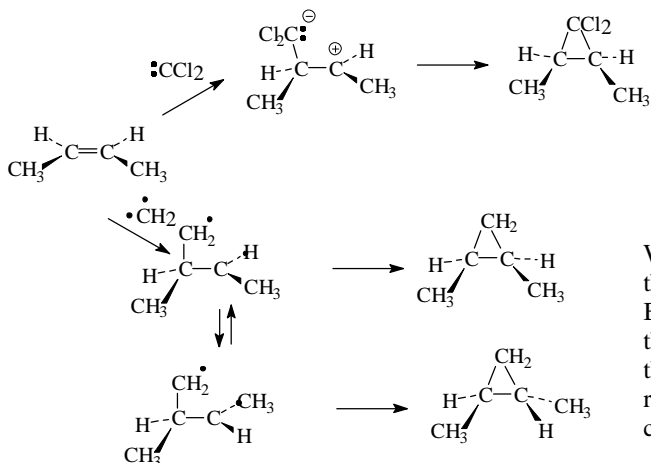
(4) VI. What role does DMSO play in the reaction shown below.



Note that this is reaction G from the preceding page. How many teachers ask you a question on one page and give you the answer on the next.

Water and 1-pentene do not mix so they react very slowly if at all. The role of the DMSO (which is of intermediate polarity) is to enhance the solubility of the 1-pentene in the bromine water so that the molecules can encounter one another and react.

(4) VII. Below is the slide that I used Wednesday during the discussion of the use of carbenes to form cyclopropane rings. Use it to explain why the use of a singlet carbene like dichlorocarbene produces only one stereoisomer that retains the configuration of the original alkene while the use of a triplet methylene results in the formation of both possible stereoisomers.



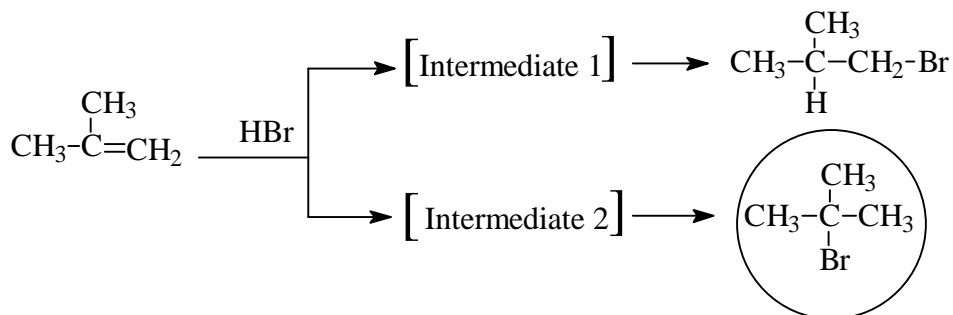
Because of the positive and negative charges, this ring closure occurs immediately after the dichlorocarbene attacks the double bond. This occurs too fast for rotation to occur around the newly formed single bond so only the one isomer is produced.

When a triplet methylene attacks the double bond the two unpaired electrons have the same spin. Before the bond can form to close the ring one of the electrons must undergo a change in spin. Since this is a slow process, the single bond undergoes rotation for a long time. Therefore when the ring closes, either of the two isomers can be formed.

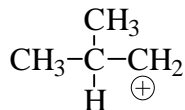
(4) IX. Your best friend brings you a sample of a chemical and asks you to test it to see if it contains any double bonds. You take the sample to the organic lab, place some in a small test tube, and add a solution of Br_2/CCl_4 to it. Explain what you expect to see and how you will interpret the results to your friend who wants to know how the test works.

Bromine is red. If it is added to the compound and the color disappears this means that the bromine has reacted with the compound. Bromine undergoes an addition reaction with carbon-carbon double bonds. So if the color goes away, the compound must have contained at least one double bond.

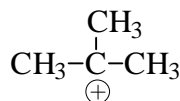
(10) X. Isobutylene can potentially add HBr in the two ways shown below:



1) Draw structural formulas for the two intermediates.



Intermediate 1



Intermediate 2

- 2) Only one of the products is actually formed; circle it.
- 3) Now explain why that product is the only one formed.

The rate-determining step is the formation of the carbocation. Since the tertiary carbocation is lower in energy (more stable) than the primary carbocation, it is formed faster. This is because the transition states leading to the carbocations (first step) look very much like the carbocations they are in the process of becoming. Therefore the lower energy carbocation (tertiary) also has the lower energy transition state and a lower energy of activation for its formation.