Chem 2210-02 Organic Chemistry

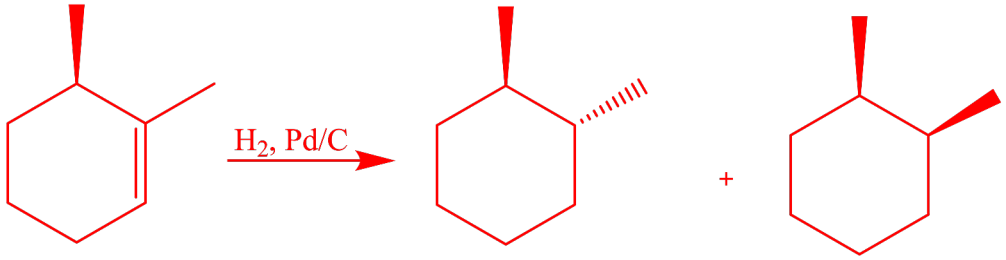
Exam 2

November 10, 2017

1. Write example for a stereoselective reaction, a regioselective reaction, and an stereospecific reaction. (9%)

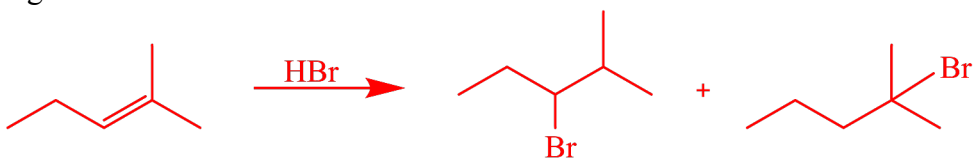
Ans:

stereoselective reaction



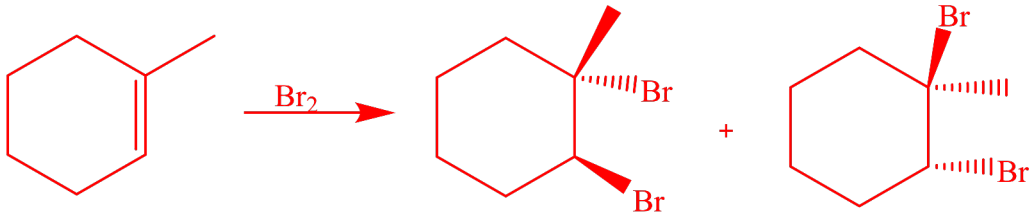
major

regioselective reaction



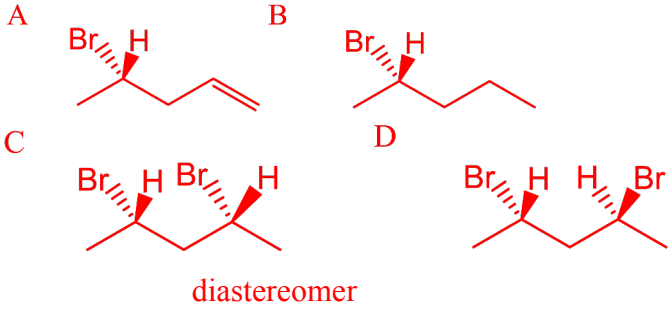
major

stereospecific reaction



2. A chiral compound **A** has a molecular formula C_5H_9Br with an *S* configuration at the chiral center. After hydrogenation, compound **A** was converted to a chiral product **B**. When compound **A** was treated with HBr, two dibromo compounds **C** and **D** were produced. Compound **C** is chiral and compound **D** is achiral. What are the molecular structures of **A**, **B**, **C**, and **D**? What is the relationship between **C** and **D**? (16%)

Ans:



diastereomer

An optically active compound (**E**), C_6H_{10}, reacts with H_2/Ni to produce compound (**F**), C_6H_{14}. (**F**) is optically inactive. Deduce the structures of (**E**) and (**F**). (8%)

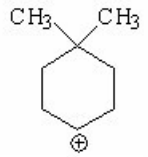
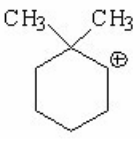
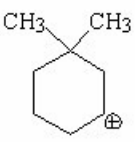
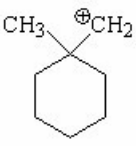
Ans:

E F

or

E F

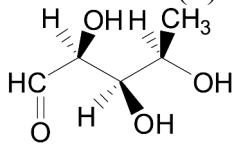
4. Which of the following carbocation(s) is/are likely to rearrange? Why. (5%)

I.  II.  III.  IV. 

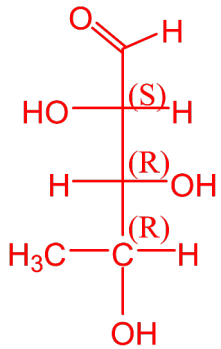
Ans: II、IV

Because II & IV are secondary and primary carbocation, they will rearrange to form more stable carbocations.

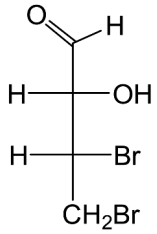
5. (a) Convert the following perspective formula to Fischer projection. Label each chiral carbon atom as (*R*) or (*S*). (5%)



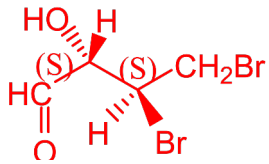
Ans:



(b) Convert the following Fischer projection to perspective formula. Label each chiral carbon atom as (*R*) or (*S*). (5%)



Ans:



6. Which of the following compounds will react most rapidly with HCl? Give a brief reason for your prediction. (5%)
   (a) 5-methyl-1-hexene
   (b) 4-methyl-1-hexene
   (c) (*E*)-5-methyl-2-hexene
   (d) (*E*)-2-methyl-3-hexene
   (e) 2-methyl-2-hexene

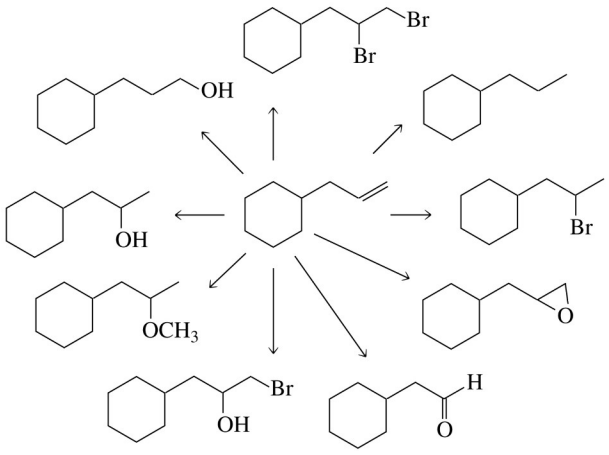
Ans: (e) 2-methyl-2-hexene

The 2-methyl-2-hexene will form tertiary carbocation intermediate, which has the lower energy. Therefore 2-methyl-2-hexene has lower activation energy, thus they would react more rapidly with HCl.

7. How many asymmetric centers are present in a molecule of 2,4,6-trimethylheptane? (3%)

Ans:0

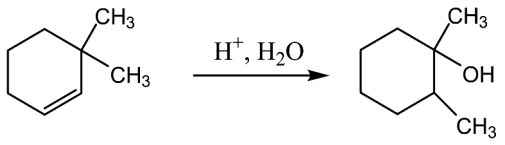
8. Provide necessary reagent(s) to complete each of the following reactions. (18%)



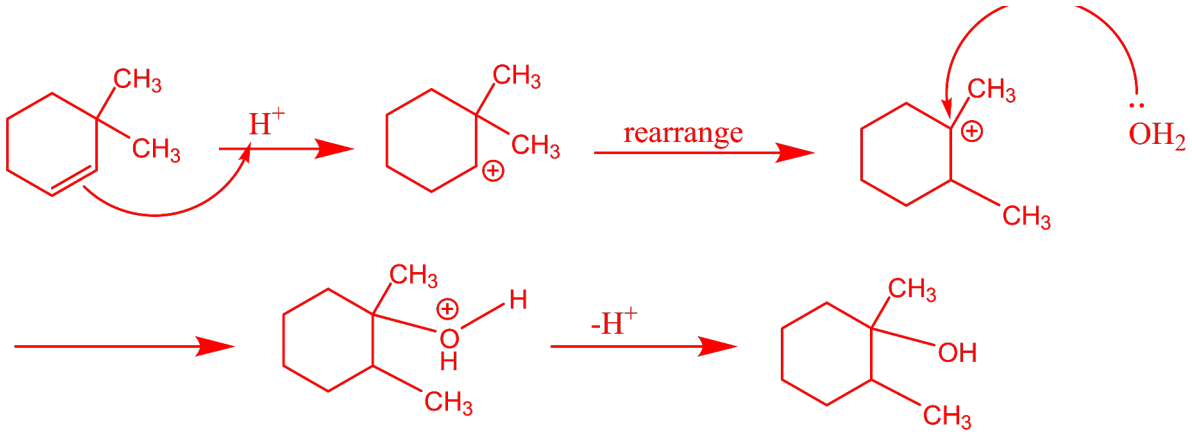
9. The specific rotation of (*R*)-(+)-glyceraldehyde is +8.7. If the observed specific rotation of a mixture of (*R*)-glyceraldehyde and (*S*)-glyceraldehyde is +1.4, what percent of glyceraldehyde is present as the *S* enantiomer? (3%)

Ans:41.955%

10. Propose a reaction mechanism for the following reaction. (6%)



Ans:



11. In a reaction in which reactant **G** is in equilibrium with product **H** at 25 °C, what relative amounts of **G** and **H** are present at equilibrium if $\Delta G°$ at 25 ºC is 2.72 Kcal/mol? Gas constant = 1.987 cal/mol ºK (3%)

Ans: **G**: **H**=100:1

12. How many of the following names are correct? Correct the incorrect names. (10%)

a. 3,4-dimethylpentane **b.** 2,8-dimethyl-4-ethylnonane **c.** 3,6,8-trimethyldecane
d. 2-chloropent-l-ene **e.** (3*Z*,6*Z*)-3,6-dimethyldeca-3,6-diene

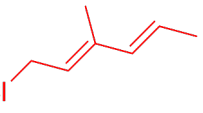
Ans:

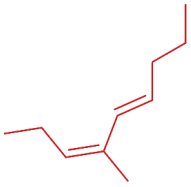
a. 3,4-dimethylpentane → 2,3-dimethylpentane
b. 2,8-dimethyl-4-ethylnonane → 4-ethyl-2,8-dimethylnonane
c. 3,6,8-trimethyldecane → 3,5,8-trimethyldecane
d. 2-chloropent-l-ene correct
e. (3*Z*,6*Z*)-3,6-dimethyldeca-3,6-diene correct

13. Draw structures for the following: (4%)

a. (2*E*,4*E*)-l-chloro-3-methyl-2,4-hexadiene **b.** (3*Z*,5*E*)-4-methyl-3,5-nonadiene

Ans:

a. 

b. 

14. Identify two alkenes that react with HBr to form 1-bromo-l-methylcyclohexane without undergoing a carbocation rearrangement. (6%)

Ans: