

Department of Chemistry, Realfagbygget

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EXAMINATION IN KJ 1020

Tuesday 1 June 2010

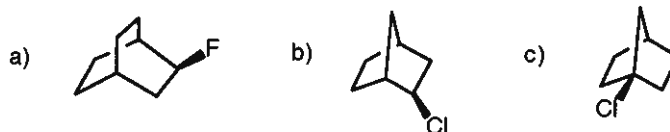
Time: 09.00-14.00

Use of molecule kit is allowed

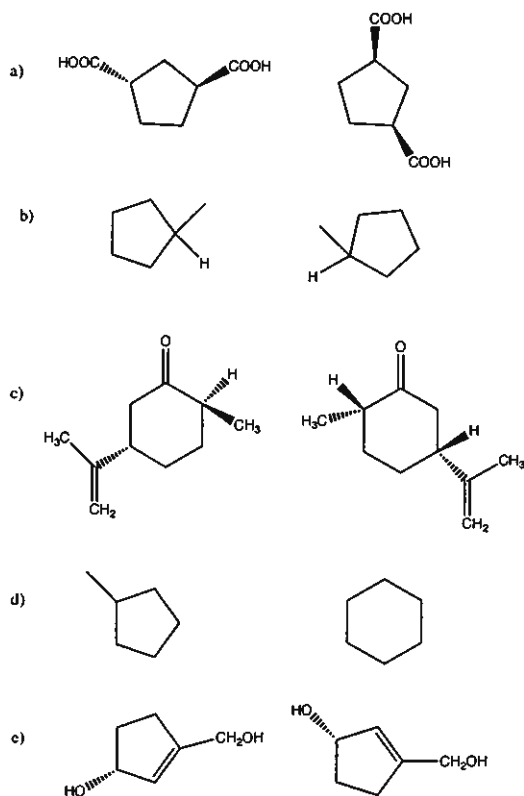
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**PROBLEM 1**

A) Which of the following molecules are chiral ? Give the configuration (R or S) for the chiral molecules.



B) Consider the following pairs of structures. Identify the relationship between them by describing them as representing two molecules of the same compound **I**, constitutional isomers **K**, enantiomers **E** or diastereomers **D**.

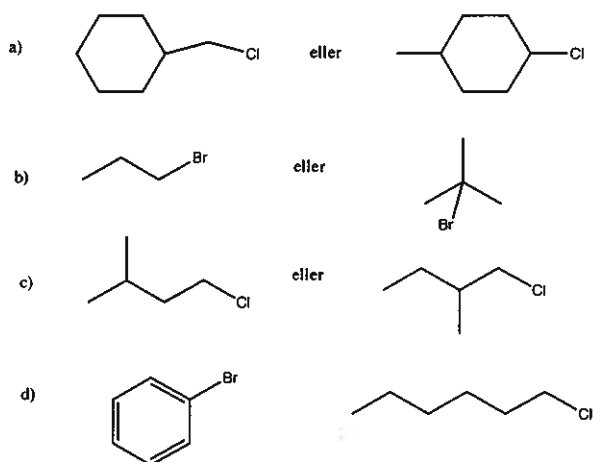


C) Write the structural formulas for the compounds below:

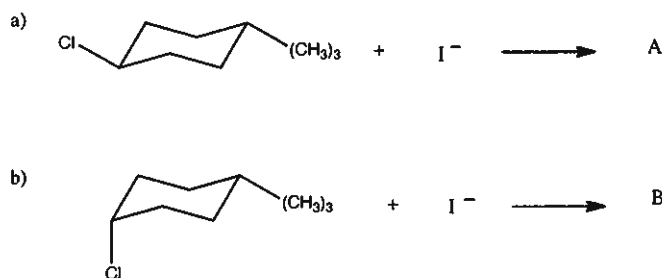
- a) (*E*)-2-pentene
- b) (*Z*)-1-cyclopropyl-1-pentene
- c) (*Z*)-3-heksene
- d) *trans*-2-bromo-cyclopentanol

## PROBLEM 2

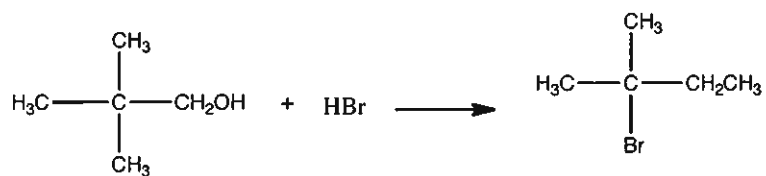
A) Which of the pairs below will react faster in a  $S_N2$  reaction ?



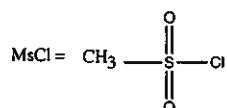
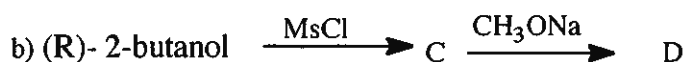
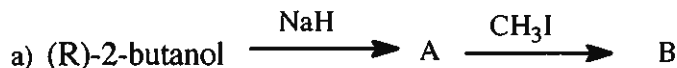
B) Give the structures for the products A and B and the reaction mechanism. What kind of isomers are A and B ?



C) The following reaction below has been observed. Give the mechanism that explains the formation of the product.

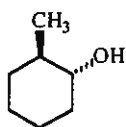


D) Give the structures and the stereochemistry for the missing molecules in the reactions below. Which kind of isomers are B and D? Don't give the mechanism for the reaction.

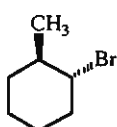


### PROBLEM 3

A) The acid-catalyzed dehydration of *trans*-2-methylcyclohexanol (1) gives as main product 1-methyl-cyclohexene while the dehydrohalogenation of *trans*-1-bromo-2-methylcyclohexane (2) affords as main product 3-methyl-cyclohexene-1-ene. Explain the formation of the different products by the mechanism for the reactions.



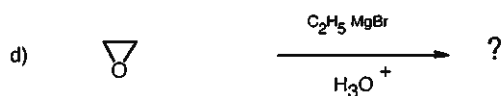
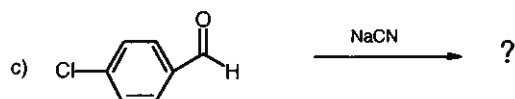
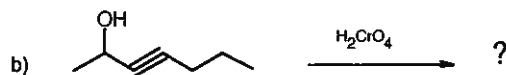
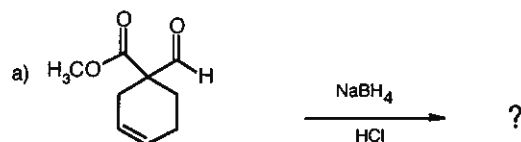
(1)



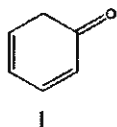
(2)

B) The addition of HBr to 1,3-butadiene at  $-80^\circ\text{C}$  gives to products. Write the to products and the mechanism for the reaction. Explain why 1,2-addition product occurs faster and why 1,4-addition product is more stable.

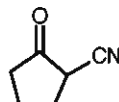
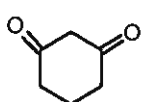
C) Give the structure (not the mechanism) of the products in the following reactions :



D) Write the enol form for the ketone 1. Do you expect more of the enol or the keto form ?

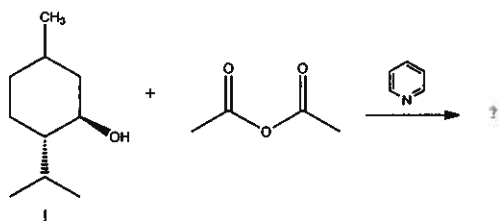


E) Indicate with a star for the molecules below the most acidic hydrogen atoms. Write all the resonance structures for the anion formed when the most acidic hydrogen atom is removed.

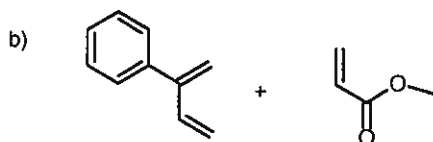
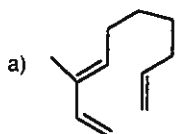


#### PROBLEM 4

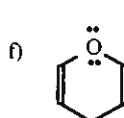
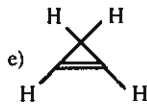
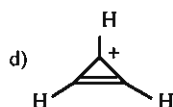
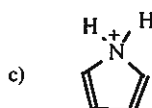
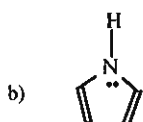
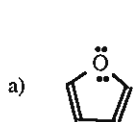
A) Write the structure of the product and the detailed mechanism for the reaction between menthol (1) and acetic anhydride in pyridine at 0 °C.



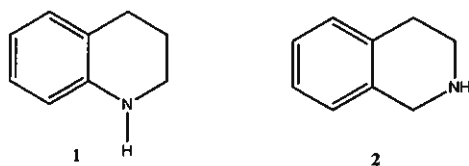
B) Which products are formed in the Diels-Alder reactions below?



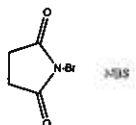
C) Classify the molecules/ions below as aromatic or not aromatic. Explain your answer.



D) Compare the basicity of the compounds below. Explain your answer

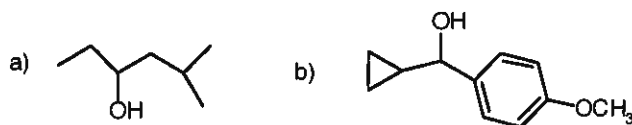


E) Which product expect you when N-Bromosuccinimide (NBS) in  $\text{CCl}_4$  reacts with :  
 a) cyclopentene  
 b) toluene

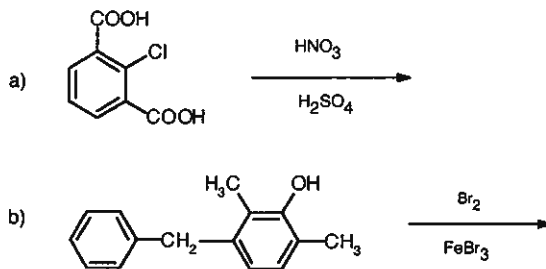


### PROBLEM 5

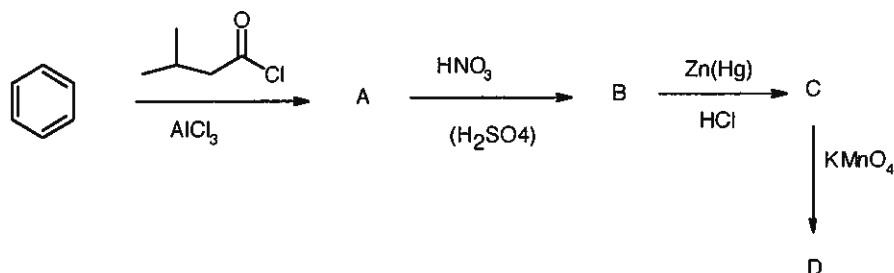
A) Which carbonyl compounds and Grignard reagents you need for the synthesis of the alcohols below. Give also the mechanism for the reactions.



B) In the reactions below only one substitution product can be formed. Propose the structures.



B) Give the structures for the compounds A, B, C and D missing in the reaction below.



C) 2-Methyl-3-phenyl-propionaldehyde (propanal) can be synthesized from benzaldehyde and propionaldehyde in the presence of a base.

- a) What is the name of this reaction ?
- b) Write all the steps for the mechanism
- c) Which by-product would you expect?
- d) How can you avoid by-products ?