

UNIVERSITY OF SWAZILAND
FINAL EXAMINATION 2008, DECEMBER

TITLE OF PAPER : Introductory Organic Chemistry

COURSE NUMBER : C203

TIME : Three Hours

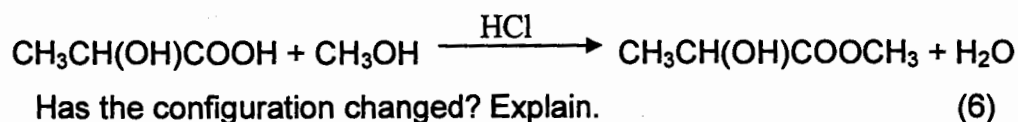
INSTRUCTIONS : Answer any **FOUR** questions. Each question carries **25** marks

This Examination Paper Contains Six Printed Pages Including This Page

***You are not supposed to open the paper until permission to do so has been
grated by the Chief Invigilator.***

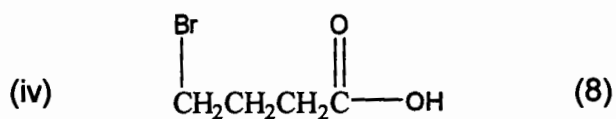
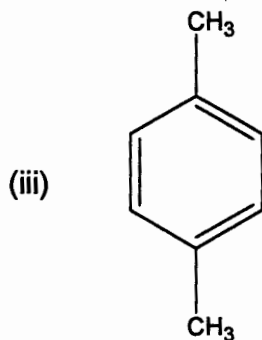
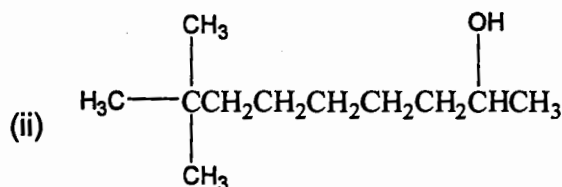
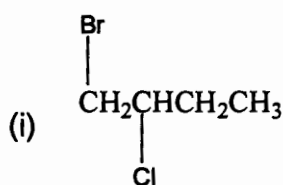
Question 1

- (a) (i) Write two isomeric structures of the compounds with the molecular formula C_2H_6O .
- (ii) Name the two isomers
- (iii) Give the organic classes of these compounds (5)
- (b) Briefly explain the following terms and give appropriate examples (10)
- (i) Stereoisomers
- (ii) Enantiomers
- (iii) Racemic mixture or racemate
- (iv) Chiral molecule
- (v) Stereocenter
- (c) Write the Fischer Projection structures for: (4)
- (i) (R)-2-butanol
- (ii) (S)-glyceraldehyde {2,3-dihydroxypropanal, $HOCH_2CH(OH)CHO$ }
- (d) Esterification of (-)-lactic acid with methanol gives (+)-methyl lactate



Question 2

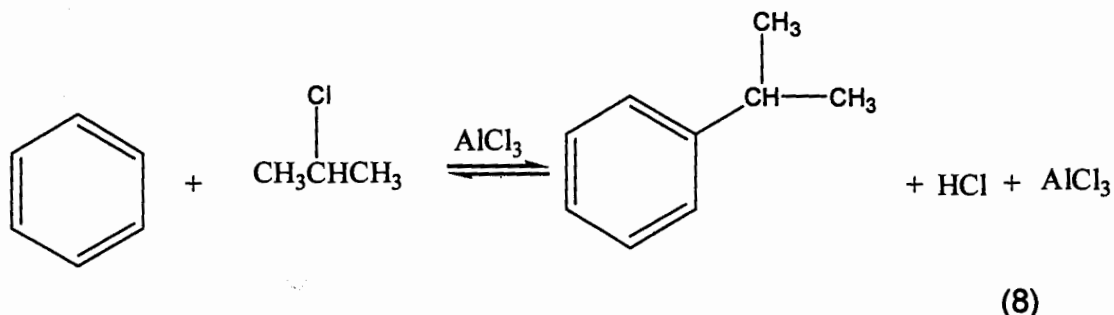
- (a) Give IUPAC names for the following compounds:



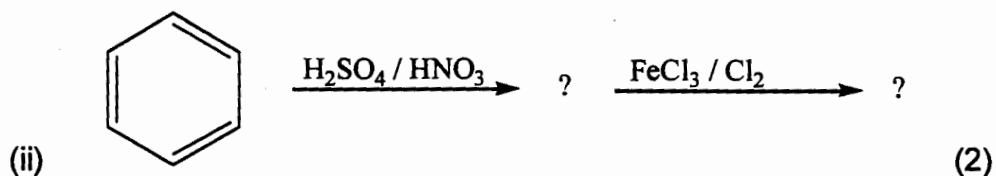
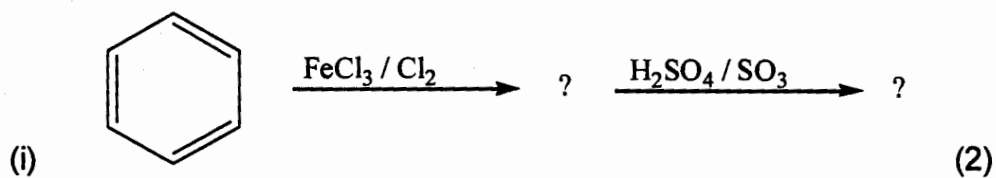
- (b) Compare S_N1 and S_N2 reactions and state the factors that affect these reactions. (5)
- (c) Arrange the following alkyl bromides in order of decreasing reactivity in an S_N2 reaction; 1-bromo-2-methylbutane, 1-bromo-3-methylbutane, 2-bromo-2-methylbutane, and 1-bromopentane (4)
- (d) Determine the products that will be formed from the S_N2 reaction of:
- 2-bromobutane and hydroxide ion (OH^-)
 - (R)-2-bromobutane and hydroxide ion (OH^-)
 - (S)-3-chlorohexane and hydroxide ion (OH^-)
 - 3-iodopentane and hydroxide ion (OH^-) (8)

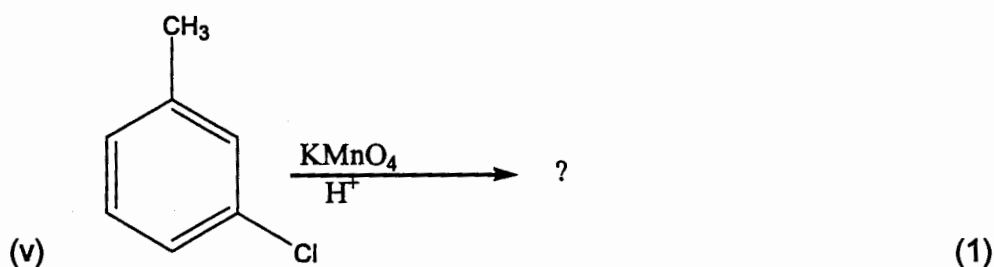
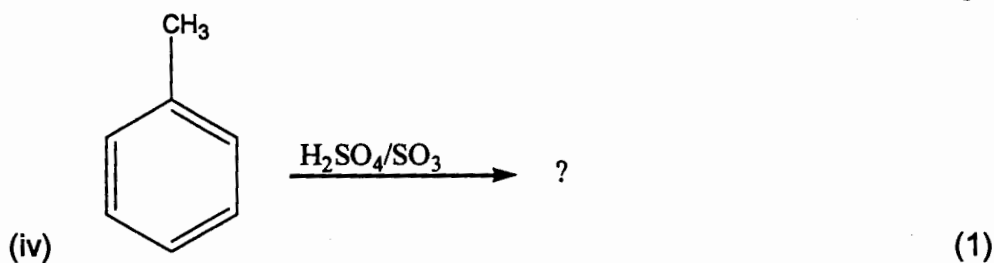
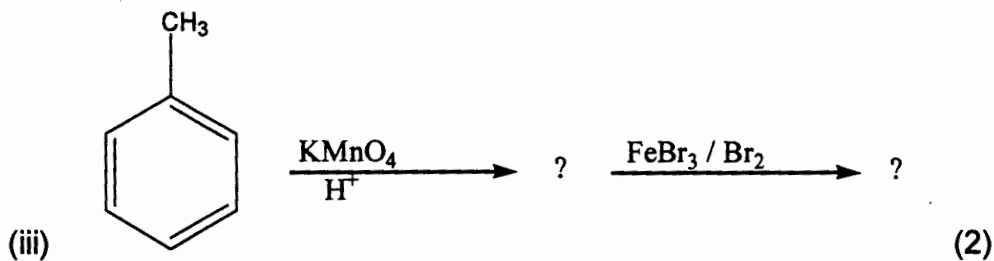
Question 3

- (a) Outline the mechanism for the following Friedel-Crafts Alkylation reaction:



- (b) Write the structure of the indicated intermediate products and the principal organic products of the following reactions:



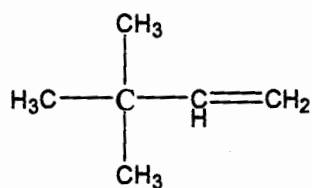


(c) Explain the following observations:

- (i) Benzene undergoes electrophilic aromatic substitution and not electrophilic addition. (3)
- (ii) Resonance effect in the reactions of aromatic benzene. (3)
- (iii) Inductive effect in the reactions of aromatic benzene. (3)

Question 4

(a) Give the mechanism for the acid-catalysed hydration of alkenes using 3,3-dimethyl-1-butene.



3,3-dimethyl-1-butene (10)

- (b) Outline the steps of the hydration of 3,3-dimethyl-1-butene using the oxymercuration-demercuration mechanism. (10)
- (c) Do the reactions in (a) and (b) follow the Markovnikov's rule? Explain your answer. (3)
- (d) Which of the above reactions is regioselective? Explain your answer. (2)

Question 5

- (a) Give a brief description of how the following classes of compounds could be separated:
- (i) Secondary alcohols and tertiary alcohols
 - (ii) Phenols and carboxylic acids
 - (iii) Aldehydes and ketones
 - (iv) Primary amines and tertiary amines (8)
- (b) Outline the synthesis of 4-octanol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$) from butanal ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$) and butylmagnesium bromide ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{MgBr}$) (5)
- (c) (i) How would you prepare phenylmagnesium bromide? (4)
- (iii) What would be the product of the reaction of phenylmagnesium bromide with each of the following reagents?
1. H_2O
 2. $\text{C}_6\text{H}_5\text{COCl}$
 3. H_2CO
 4. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$ (8)

Question 6

- (b) Keto enol tautomerism can be both base and acid-catalysed. Show the mechanisms for both reactions. (10)
- (c) Define the terms:
- (i) Aldol addition
 - (ii) Crossed or mixed aldol additions (4)

- (d) What kinds of products are formed from these reactions? (2)
- (e) Show the net reactions for the formation of the aldol adduct from
- (i) propanal in dilute NaOH
 - (ii) acetone in dilute NaOH (4)
- (e) Outline a general mechanism for the acid-catalyzed aldol additions of carbonyl compounds. (5)