UNIVERSITY OF SWAZILAND
FINAL EXAMINATION 2015, DECEMBER

TITLE OF PAPER	:	Introductory Organic Chemistry
COURSE NUMBER	:	C203
TIME	:	Three Hours
INSTRUCTIONS	:	Answer any **FOUR** questions. Each question carries **25** marks

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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) Determine the effect, if any, on the configuration of (s)-butanol on performing each of the following operations: (3)

i. Exchanging ligands (groups) across the horizontal bond

ii. Exchanging ligands across the vertical bond and across the horizontal line at the same time

iii. Exchanging a vertical and horizontal ligand

(b) Define the following: (6)

i. Chiral centre

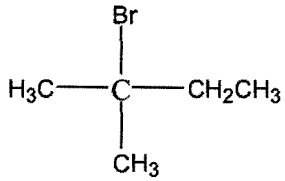
ii. Dextrorotatory compound

iii. Meso compound

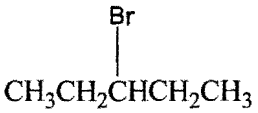
(c) Rank the following alkyl halides in order of decreasing reactivity in;

(i) S_N1 mechanism

(ii) S_N2 mechanism

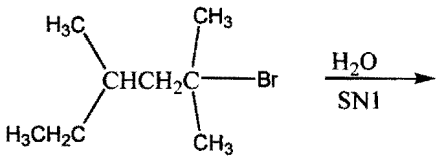


$CH_3CH_2CH_2CH_2CH_2Br$



(6)

(a) Show all the steps of the following reaction by S_N1 mechanism. Write the names of the main reactant and product.



(10)

Question 2

a. Draw the structures of the following compounds: (8)

i. 2-chloropropanal

ii. 3-hydroxypentanal

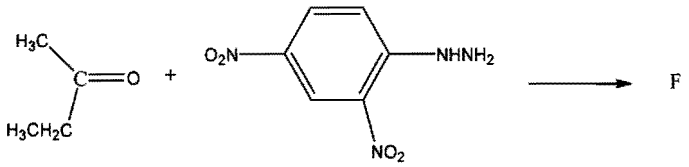
iii. 1,4-pentadiene-3-one

iv. 1,3-cyclopentanedione

b. Write the intermediates and products of the following reactions (12)

i. $CH_3CH_2CH_2OH \xrightarrow[ZnCl_2]{HCl} A \xrightarrow{Mg/\ ether} B$

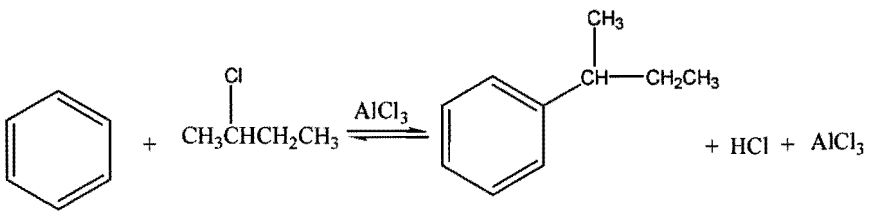
ii. $CH_3CH_2CH_2OH \xrightarrow{CrO_3} C \xrightarrow{D} CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}HCH_2CH_2CH_3 \xrightarrow{KMnO_4/OH^-} E$

iii. 

c. write the steps for the formation of a hemiacetal from the acid catalysed reaction of propanal and ethanol (5)

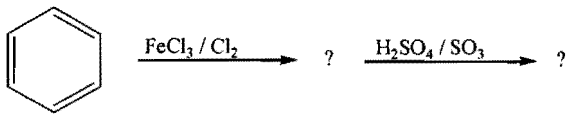
Question 3

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

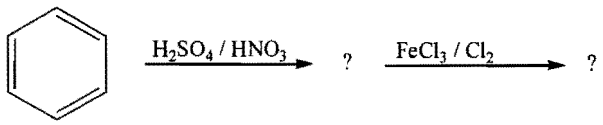


(10)

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

(i) 

(2)

(ii) 

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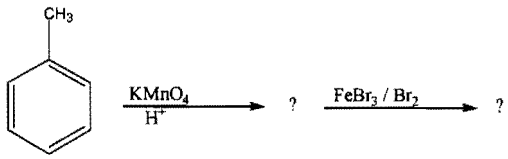
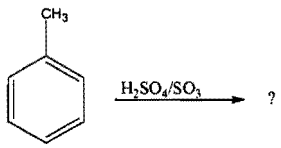
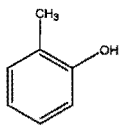
(iii) 

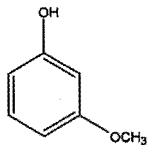
(3)

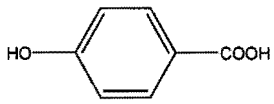
(iv) 

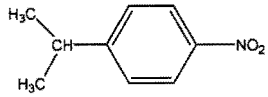
(2)

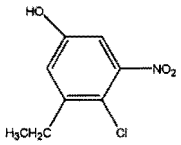
(c) Name the following compounds: (5)

(i) 

(ii) 

(iii) 

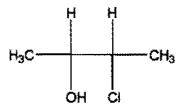
(iv) 

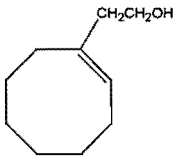
(v) 

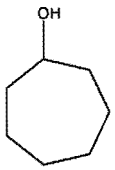
Question 4

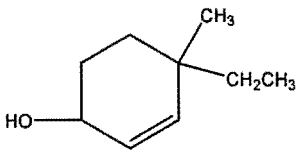
(a) Name the following compounds: (5)

i. $CH_3CHClCH(CH_3)CH_2OH$

ii. 

iii. 

iv. 

v. 

(b) Why is it not possible to obtain a halide by reacting ROH with a halide ion? (2)

(c) Give the mechanism for the reaction of $(CH_3)_3CCH(CH_3)OH$ with conc. HCl to form $(CH_3)_2CClCH(CH_3)_2$ but no $(CH_3)_3CCH(CH_3)Cl$ (10)

(d) Give the product name and structure for the reaction of 3,3-dimethyl-1-butene with:

i. an acid and water

ii. Oxymercuration-demercuration mechanism

iii. Hydroboration-oxidation (6)

(c) Which of the above reactions is regioselective? Explain your answer. (2)

Question 5

(a) Draw structures of the following compounds:

(i) 3-aminopropanol

(ii) N,N-dimethyl-2-aminobutane

(iii) *p*-aminobenzoic acid

(iv) 1,5-pentanediamine

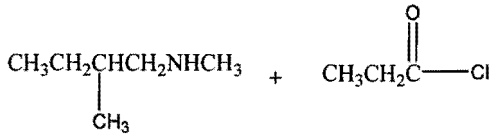
(v) Trimethylamine (10)

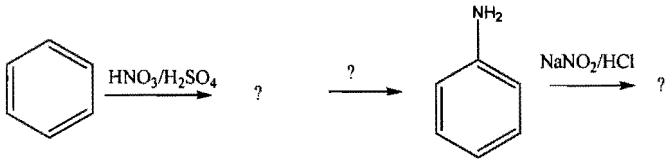
(b) Give the products of the following reactions: (15)

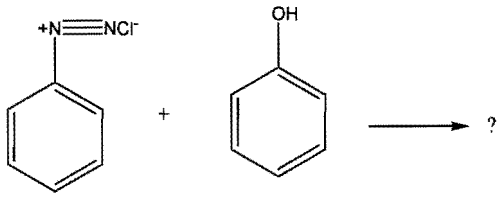
i. $CH_3Br + CH_3CH_2NH_2$

ii. $CH_2{=}CHCH_2Br + (CH_3)_2NH$

iii. $PhCH_2Br + CH_3CH_2NHCH_3$

iv. 

v. 

vi. 

Question 6

a. Outline the synthesis of 4-octanol ($CH_3CH_2CH_2CH(OH)CH_2CH_2CH_2CH_3$) from butanal ($CH_3CH_2CH_2CHO$) and butylmagnesium bromide ($CH_3CH_2CH_2CH_2MgBr$) (10)

b. Write a valid mechanism for the esterification of benzoic acid and ethanol (10)

c. Explain why carboxylic acids usually have higher boiling points than alkanes with the same number of carbons (5)