UNIVERSITY OF SWAZILAND
FINAL EXAMINATION 2012, 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 Seven Printed Pages Including This Page

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Question 1

(a) Draw structures for the following organic compounds. (10)

i. N-Ethyl-N-methylbutanamine
ii. *cis*-1-bromopentene
iii. 2,5-dimethyl-3-heptene
iv. 3,4,4-trimethyl-2-hexanol
v. 3-methyl-2-pentanone
vi. Chlorobenzene
vii. 2-ethoxy-4-methoxyhexanal
viii. Cyclobutylphenyl ether
ix. 4-methyl-2-octyne
x. 3-flourobutanoic acid

(b) The following names are incorrect. Draw the structures from the given name, explain why the name is wrong and give the correct IUPAC name.

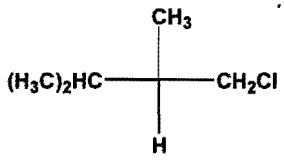
i. 3-methyl-1,3-butadiene
ii. 2-isobutyl-4-isopropylhexane
iii. 5-chloro-3-ethyl-4-pentene
iv. 1,2,2-trichloro-4-pentene
v. 2-methylcyclohexene (15)

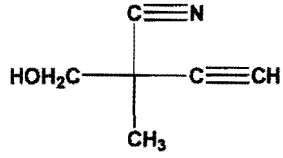
Question 2

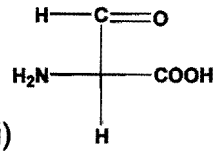
(a) Define the following stereochemical terms (10)

(i) Diastereomers
(ii) Chiral centre
(iii) Racemic mixture or racemate
(iv) Chiral molecule
(v) Meso compound

(b) Identify each of the following as R or S, and show the priorities assigned to each ligand. (6)

i) 

ii) 

iii) 

(c) How many stereoisomers of 2,3-butanediol are possible? Draw them.(4)

(d) What is racemic resolution? (1)

(e) Give methods for resolving a racemate. (4)

Question 3

a) What is the general formula for an alkane? (2)

b) Give the molecular formulas for alkanes with: (4)

i. Four C's
ii. Seven C's
iii. Ten C's
iv. 22 C's

c) Define an alkyl group and give the formula for each of the following alkyl groups: (4)

i. Butyl
ii. Propyl

d) Provide a structural formula for $CH_3CH_2C(CH_3)_2CH_2CH(CH_3)_2$, and define and identify all the primary (1°), secondary (2°), tertiary (3°) and quaternary (4°) carbons. (5)

e) Define the term conformation. (6)

i. Name and draw the conformations of ethane with the lowest and highest energies at room temperature.

f) Write the structures of all the alkenes that can be hydrogenated to form 2-methypentane. (4)

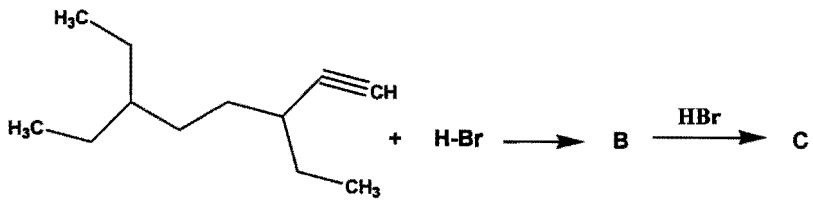
Question 4

a) Compare S_N1 and S_N2 reactions and state the factors that affect these reactions. (5)

b) Complete the following chemical reactions by filling in all missing products and by-products (A, B, C and D).

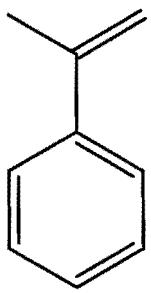
i. 

(2)

ii. 

(2)

c) 2-Benzyl propene reacts with hydrogen bromide and undergoes electrophilic addition reaction:



i) State Markovnikov's rule. (1)

ii) Provide the reaction scheme and the mechanistic pathway of the above reaction. (3)

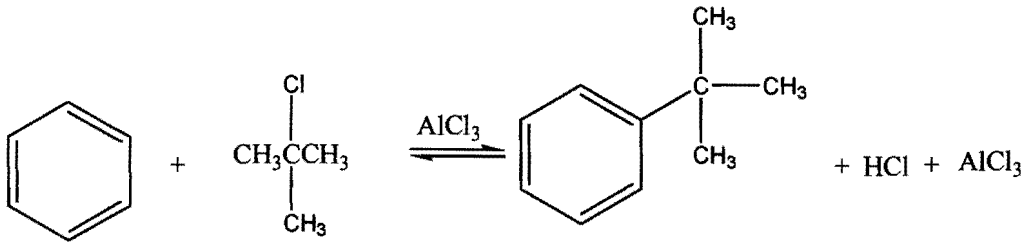
iii) What reagent should be used so that the reaction follows anti-Markovnikov's rule? (2)

d) The hydrolysis of 2-iodo-3-methylbutane yields a tertiary alcohol as the major product. Provide an equation, with mechanism, for this reaction and explain why the tertiary alcohol is the major product. Also, give the name and structure of both the major and minor products. (10)

Question 5

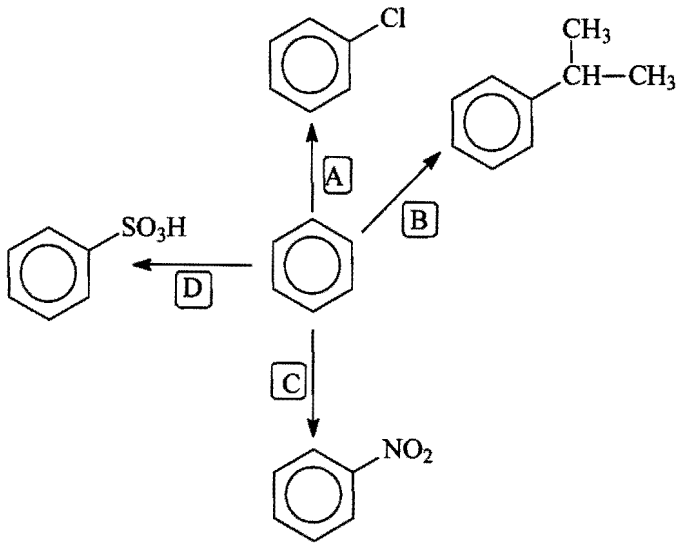
(a) Draw the two Kekule resonance structures for 1,2-dimethylbenzene.(2)

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



(10)

(c) Complete the following reactions by supplying the missing reagents only.



(8)

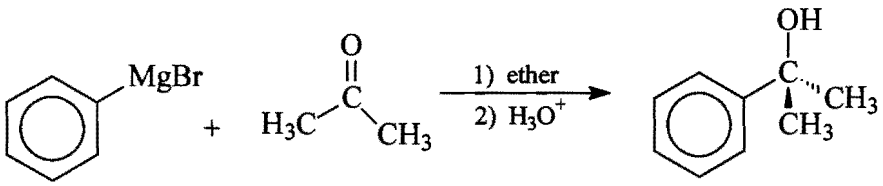
(d) Explain the following observations:

(i) Benzene undergoes electrophilic aromatic substitution and not electrophilic addition. (3)

(ii) Inductive effect in the reactions of aromatic benzene. (2)

Question 6

(a) Consider the Grignard reaction: (6)

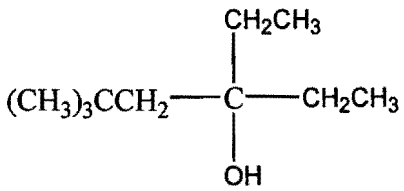


i. What is the electrophile in this reaction?

ii. What is the nucleophile in this reaction?

iii. What type of alcohol is the product in this reaction?

(b) Outline 3 routes of Grignard synthesis of the following compound. (only write the structural formula of the carbonyl compound and Grignard reagent for each synthesis). (6)

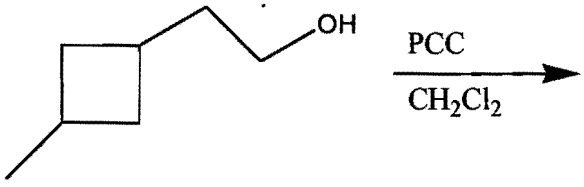


(c) Complete the following reactions by providing the missing reagents, intermediates and products.

(5)

i. $CH_3CH_2CH_2OH \overset{?}{\rightleftharpoons} CH_3CH_2CHO \overset{?}{\rightleftharpoons} CH_3CH_2COOH$

ii.



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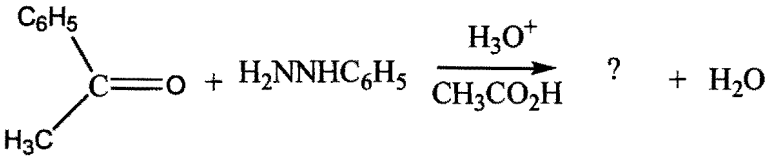

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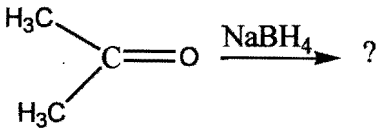

(d) Define the Aldol addition (2)

(e) Outline a general mechanism for the base-catalyzed aldol additions of an aldehyde to form a β-hydroxyaldehydes. (6)