KABARAK  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHEM 121**

COURSE TITLE: **ORGANIC CHEMISTRY I**

STREAM: **SESSION I**

DAY: **TUESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **01/12/2009**

INSTRUCTIONS:

1. Attempt **ALL** questions
2. **Total marks = 70** (each question = 17.5 marks)

PLEASE TURN OVER

QUESTION ONE (17 ½ MARKS)

a) i) What is a molecular orbital? (1 ½ marks)

ii) Name two types of molecular orbitals and explain how they are formed. (4 marks)

b) Consider each of the following molecules in turn.

Dimethylether (CH_3-O-CH_3)

Trimethylamine (CH_3-N(CH_3)-CH_3)

Trimethylboron (CH_3-B(CH_3)-CH_3)

Dimethylberyllium (CH_3-Be-CH_3)

Using orbital notation,

i) Give the ground state and excited state electronic configuration of the central atom (O,N, B or Be) in each molecule. (Atomic numbers Z: 0=8, N=7, B=5 and Be =4) (4 marks)

ii) Using the excited state electronic configuration, describe the hybridization state of each central atom. (4 marks)

iii) Give the bond angle of the central atom and the shape of the molecule. (4 marks)

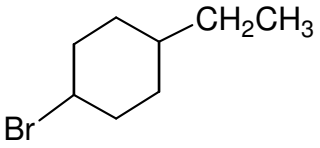
QUESTION TWO (17 ½ MARKS)

a) i. Give all possible constitutional Isomers and IUPAC names fo C_4H_9Cl molecule. (2 ½ marks)

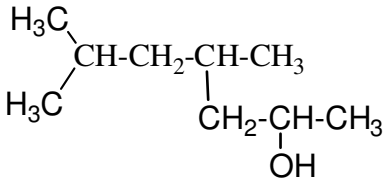
ii. Give the structures and IUPAC names of the Geometrical Isomers of 2, 3-dibromobut – 2 – ene. (2 marks)

b) i. Give the IUPAC names for each of teh following compounds.

(a)



(b)



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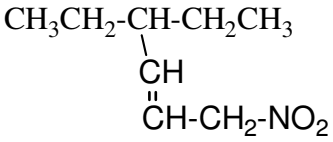

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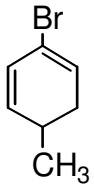

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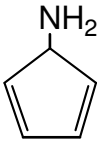
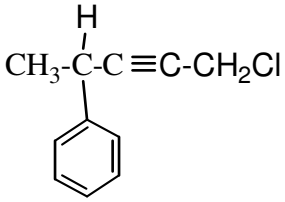


(g)



ii. Give the condensed structural formulars for each of the following compounds:

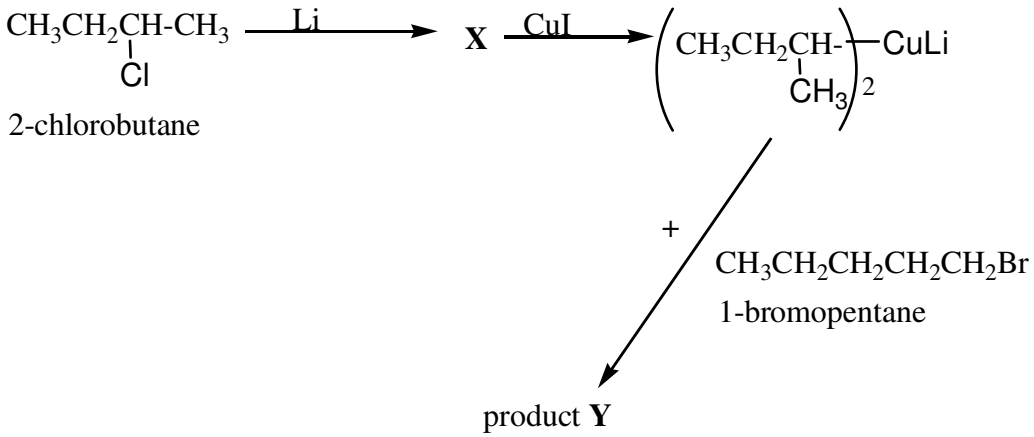
a. 2-bromobut-1, 3-diene
b. 3-Isopropylhexane
c. 5-phenyl cyclopent-1, 3- diene
d. 4 – (n) – propyl – 2 – heptyne (4 marks)

c) i. Give a simple test that can be carried out to differentiate between the following compounds:

(i) an alkane from an alkene
(ii) I-butyne from 2-butyne (2 marks)
(iii) Give the major source of hydrocarbons. (1 mark)

(QUESTION THREE (17 ½ MARKS)

a) One method of preparation of alkanes is by coupling of alkylhalides with organometallic compounds.

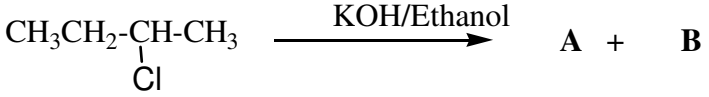


2-chlorobutane

i) Give the structure and the IUPAC name of compound X and Y. (2 marks)

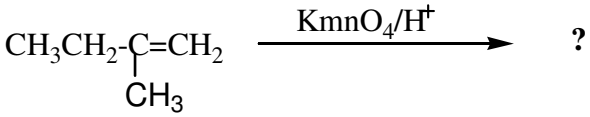
ii) Explain the major difference between this method of preparation of alkanes from other methods. (1 mark)

b) i) Complete the reaction below and indicate the major and minor products.



(2 marks)

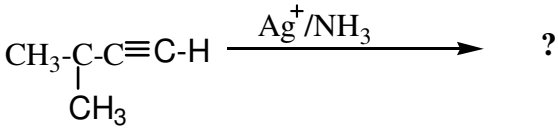
ii) Indicate the products in the reaction below:



(2 marks)

iii) What type of reaciton occurs in (ii) above? (1 mark)

iv) Complete the following reactions.



(2 marks)

v) Explain the observation of reaction (iv) above. (1 mark)

c) i) Give detailed mechanism for the reaction of I-butanol with conc. Sulphuric acid to give 2-butene and I-butene. Identify the major and minor product.
(4 ½ marks)

ii) Give detailed mechanism for electrophilic addition reaction of 2-methylpropene with HCl gas.
(2 marks)

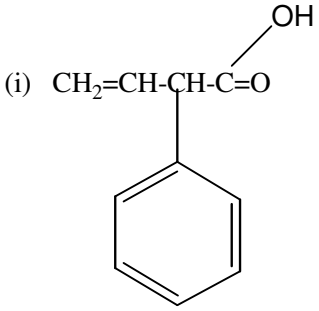
iii) If the reaction above is done in presence of a peroxide (ROOR); name the product formed. (1 mark)

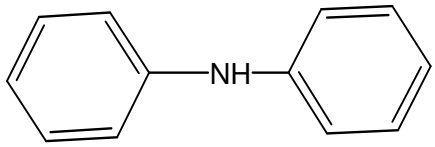
QUESTION FOUR (17 ½ MARKS)

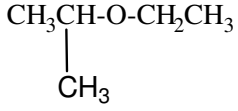
(a) Classify the following compounds into their functional groups: Tert-butyl alcohol, Butylaldehyde, 2-chlroropropane, benzanal, Phenol, M-bromo-benzoic acid, Methylphenylether, and acetic acid. (4 marka)

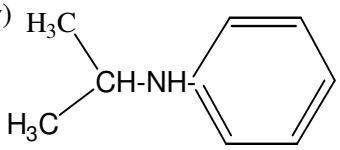
(b) Give the structures of the following conpounds: (i) Methoxycyclohexane (ii) 2-butenoic acid (iii) Cyclohexanone (iii) cyclohex-1,3-dien-5-ol (iv) 4-isopropylaminobenzene (4 marks)

(c) Give the names for the following compounds: (4marks)

(i) 

(ii) 

(iii) 

(iv) 

(d) Arrange the following compounds in order of their increasing B.point.
Diethylether, propane, butanal, Ethylmethylamine, 2-propanone and propanoic acid. (1.5 mk)

(e) In the following reactions, compound A reacts with warm concentrated H_2SO_4 to give a compound B. Copound B decolourizes Bromine water. Further reaction of compound B with excess acidified $KmnO_4$ solution produces a mixture of two compounds C and D that both reacts with Na_2CO_3 to give bubbles of CO_2. Copound A further decolourizes a few drops of acidified $KmnO_4$ solution and copound E is formed decolourizes excess $KmnO_4/H^+$ producing compound F. Compound F reacts with ethanol to produce a sweet smell of compound G, give the names and general formulas for the families of the organic compounds A, B, C, E, F and G formed in the above reactions.. (4 marks)