KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS
2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION

SCIENCE

COURSE CODE: CHEM 121

COURSE TITLE: ORGANIC CHEMISTRY I

STREAM: Y1 S2

DAY: MONDAY

TIME: 9.00 – 11.00 PM

DATE: 29/11/2010

INSTRUCTIONS:

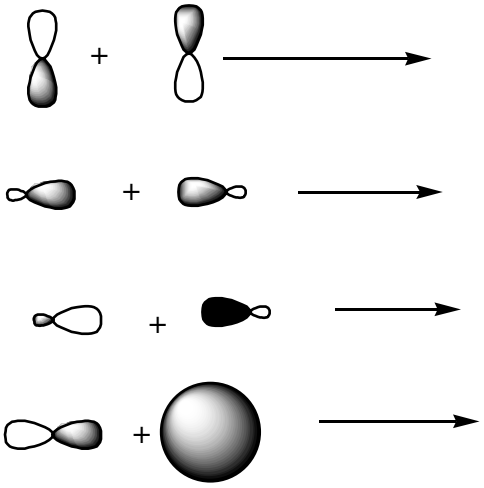
- ***Attempt ALL questions***
- **Each question = 17.5 marks, Total marks = 70 %**

PLEASE TURNOVER

QUESTION ONE

(a) (i) Define the following terms: Hybridization and molecular orbital. **(2 marks)**

(ii) Name the type of molecular orbitals formed when the following orbitals overlap as indicated below: **(2 marks)**



(iii) Identify the high and low energy molecular orbital formed in (a) (ii). **(2 marks)**

(b) (i) What is the hybridization of atoms in the following compound: **(3 marks)**

$CH_3CH(CH_3)CH{=}CHCH_2$ $C{\equiv}{\equiv}CCH_3$

(ii) Explain how each type of hybridization in (b) (i) is formed. **(3 marks)**

(c) Using orbital notation, give the ground state and excited state configuration of:

(i) Boron in BH_3 molecule (ii) Carbon in $C(CH_3)_4$ Molecule

(iii) What is the hybridization of B and C in the molecules in (c) (i) & (ii) above.

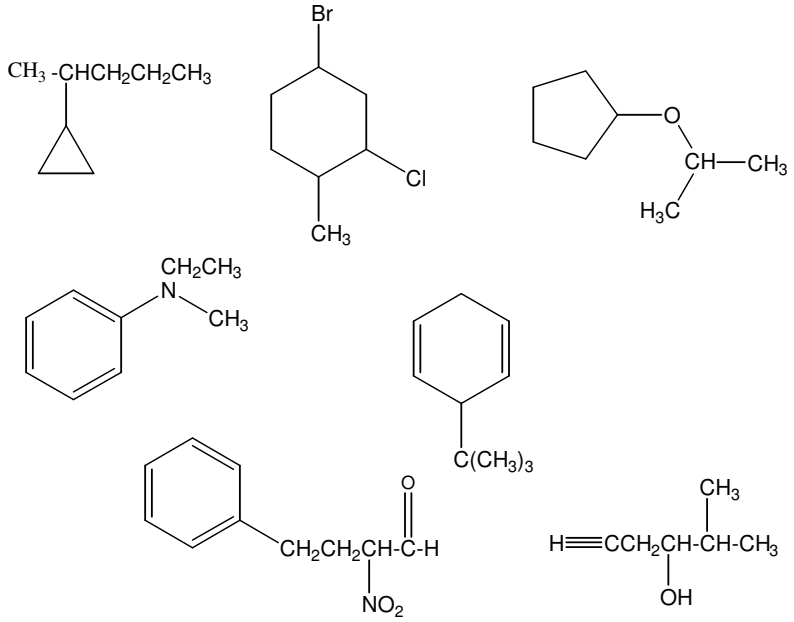
(iv) What shape is BH_3 and $C(CH_3)_4$ (Atomic number for B= 5, C = 5) **(5 marks)**

QUESTION TWO

(a) (i) Explain using example what Geometrical isomers are. **(2 marks)**

(ii) Which of the compound given in each set below has the highest Boiling point, *n*-hexane & *n*-nonane, isobutane & *n*-butane. Explain. **(4marks)**

(b) (i) Give the IUPAC names for eah of the following compounds: **(3.5 marks)**



(ii) Give the condensed structural formulas for each of the following compounds: (a) Neopentylbromide (b) 3-ethoxy-2-methylhexane (c) 5-phenylcyclopent-1,3-diene (d) 5-(1,2-dimethylpropyl)n0nane **(2 marks)**

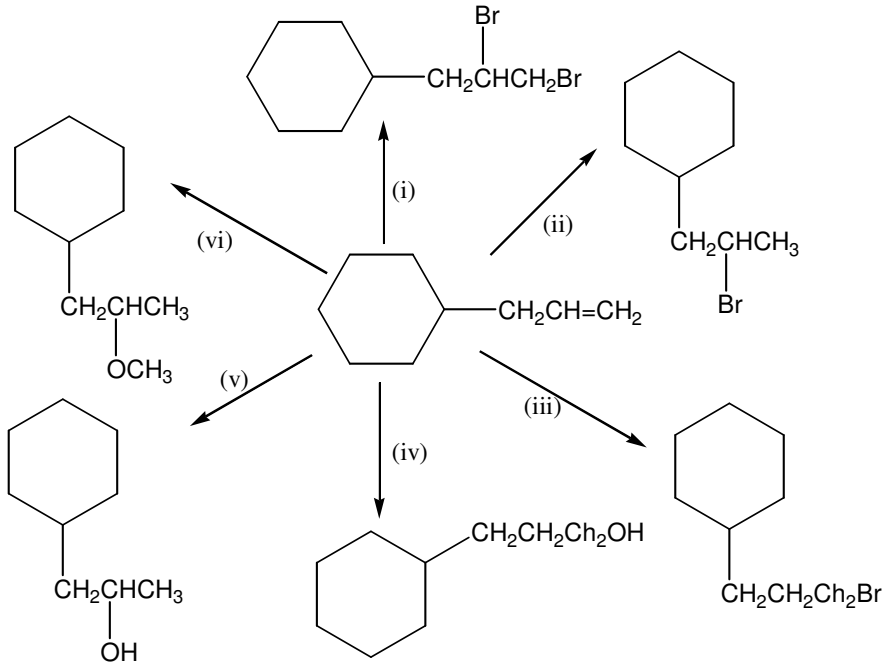
(c) (i) Outline the mechanism for mono-substitution reaction of methane gas with Chlorine gas in presence of UV-light, name the product. **(3 marks)**

(ii) Outline the mechanism for dehydration of tert-butyl alcohol with conc. H_2SO_4, name the product. **(3 marks)**

QUESTION THREE

(a) Give the reagents (i) to (iv) required to carry out the following synthesis**.**

(6 marks)

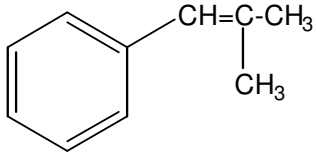


(b) Complete the following reactions and give the names of the products/reagents.

(6 marks)

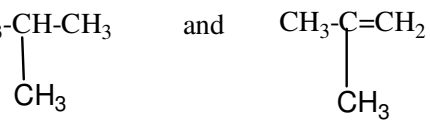
(i) $CH_3\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}CH_2Br \xrightarrow{\mathbf{A}} CH_3\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}\overset{-}{C}H_2\overset{+}{M}gBr \xrightarrow{H_2O} \mathbf{B}$

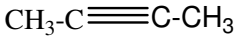
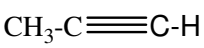
(ii) $CH_3\text{-}\underset{\displaystyle CH_3}{\underset{|}{CH}}\text{-}C\equiv C\text{-}H \xrightarrow{Ag^{+}/\,NH_3} \mathbf{C} \xrightarrow{CH_3CH_2Cl} \mathbf{D}$

(iii)  $\xrightarrow{KMnO_4\,/H^{+}}$ **E** + **F**

(c) Explain how the following compounds can be differentiated in the laboratory:

(5.5 marks)

(i)  and

(ii)  and 

QUESTION FOUR

(a). Give the general formulas and intermolecular bonds present in each of the following families of compounds: (i) Alkyl halides (ii) Ketones (iii) Carboxylic acids (iv) Ethers (v) Amines. **(5 marks)**

(b) Which of the following compound in each pair has (i) Highest boiling point 1-hexanol or 1-methoxypentane, explain. **(2 marks)**

(ii) The greatest solubility 1-butanol or propanoic acid, Explain. **(2 marks)**

(iii) The highest boiling point, isopentylalcohol or isopentylamine, Explain. **(2 marks)**

(c) Alcohols are classified into three categories. (i) Name the categories and give their general formulas

(ii) Explain an experimental methods used to classify alcohols

(iii) Give the three classes of amines and their general formulas.

(iv) Explain why amines are basic compounds

(v) Explain experimental method of analysis of a carboxylic acid. **(6.5 marks)**