KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHEM 121**

COURSE TITLE: **ORGANIC CHEMISTRY I**

STREAM: **Y1S2**

DAY: **WEDNESDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **18/03/2009**

INSTRUCTIONS:

Attempt all Questions

Total Marks = 70 (Each question = 17.5 marks)

PLEASE TURN OVER

1. (a) (i) State the ground state electronic configuration of Phosphorus (Z = 15).

(ii) State the hybridization of Phosphorus in PCl_3 and PCl_5

(iii) Explain how each of (ii) above hybrid orbitals is formed. (6 mks)

(b) (i) Explain using ethene and propyne how sigma (σ) and pi (π) bonds are formed.

(ii) Arrange the following molecular orbitals in order of increasing energy: π, σ, π* and σ*. (6 mks)

(c) (i) Define the term 'constitutional isomerism' (5.5 mks)

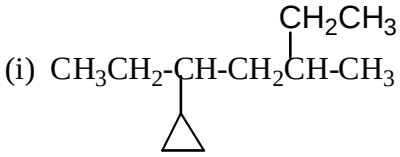
(ii) Draw and name **<u>four</u>** constitutional Isomers of $C_5H_{12}O$.

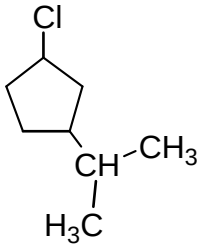
(iii) Define and give examples of the term "Geometrical isomers".

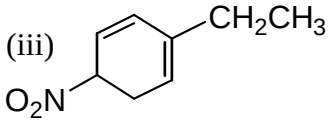
2. (a) Which of the following pairs of compounds has the higher boiling point? (5 mks)

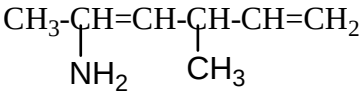
(i) *n*-butane and isobutane (ii) *n*-nonane and *n*-hexane; Explain your answer.

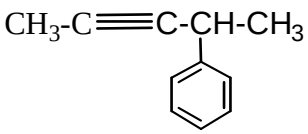
(b) Give the IUPAC names for each of the following compounds: (5 mks)

(i) 

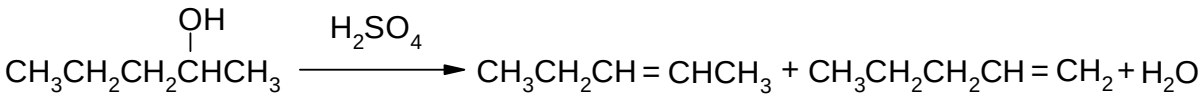
(ii) 

(iii) 

(iv) 

(v) 

(c) Consider the following reaction (7 mks)



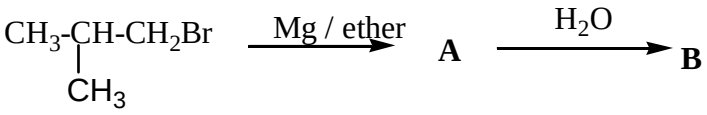
(i) State the name of the above reaction.

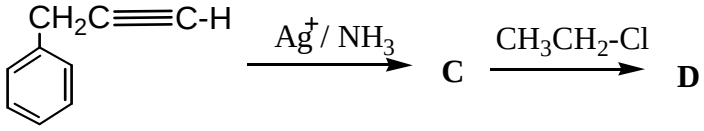
(ii) Give the IUPAC names of the major and minor products formed

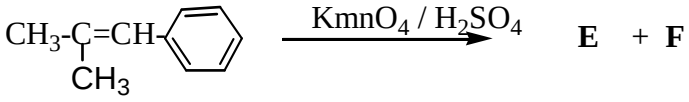
(iii) Give a detailed mechanism to show how each of the product is formed.

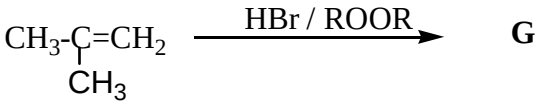
3. (a) Outline the mechanism for monosubstitution reaction of methane with bromine gas in presence of UV-light. (4.5 mks)

(b) Complete the reactions below and give the names of the products / reagents missing: (7 mks)

(i) 

(ii) 

(iii) 

(iv) 

(c) Explain how the following pair of compounds can be differentiated in the laboratory: (6 mks)

(i) 2-methylpropane and 2-methylpropene

(ii) 2-butyne and 1-butyne

4. (a) (i) Explain why alcohols have higher boiling points than the hydrocarbons with relatively similar molecular weight.

(ii) Which of the following compounds has higher solubility in water, propanoic acid or 1-propanol? Explain.

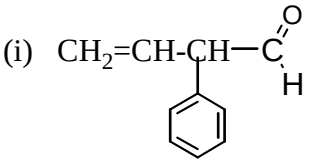
(3.5 mks)

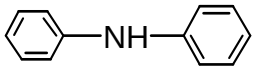
(b) Give the structures of the following conpounds: (5 mks)

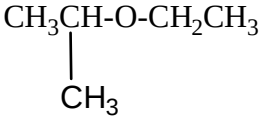
(i) Methoxycyclohexane (ii) 2-butenoic acid (iii) Cyclohexanone

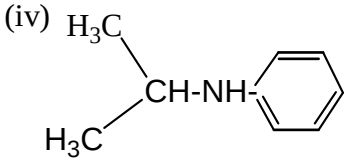
(iv) cyclohex-1,3-dien-5-ol (v) 4-isopropylaminobenzene

(c) Give the names for the following compounds: (2 mks)

(i) 

(ii) 

(iii) 

(iv) 

(d) Study the following flow-chart of series of reactions and identify the class each of the unknown compounds belongs; (7 mks)