NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTERY

END OF FIRST SEMESTER EXAMINATIONS – MAY/JUNE 2004

ORGANIC CHEMISTRY – SCH 1221

(FOR CHEMICAL ENGINEERING STUDENTS)

TIME – 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. ANSWER **ALL** QUESTIONS FROM SECTION A AND **ANY THREE** FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.

   GRAPH PAPER WILL BE PROVIDED ON REQUEST.

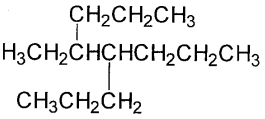
2. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.

TOTAL MARKS = 100

THIS QUESTION PAPER CONSISTS OF **FIVE PRINTED PAGES** (ON ONE SIDE ONLY) INCLUDING THE TOP PAGE WITH THE INSTRUCTIONS.

SECTION A:

1. (a) Give IUPAC names for the following compounds.

(i) $CH_3CH_2CH_2CH_2CH_2CH_3$ (ii) 

(2 Marks)

(b) The following names are incorrect. Draw structures and provide correct IUPAC names.

(i) 2,2-Dimethyl-6-ethyl heptane
(ii) 1-Ethyl-5-methyl pentane

(4 Marks)

(c) Draw E and Z configuration for the following alkenes and indicate priority on the structures.

(i) $CH_3CH_2C(CHCH_2)C(COOH)COOCH_3$

(3 Marks)

(d) What is plane-polarised light?

(4 Marks)

(e) Show the steps to assign either R or S designation to each chiral centre in the following compounds.

$CH_3CH(Cl)CH(Br)CH_3$

(6 Marks)

(f) Draw the chair conformations of the following compound and indicate with appropriate reason, which one of them is the most stable conformation.

1-chloro-2-methyl cyclohexane

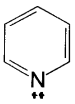
(6 Marks)

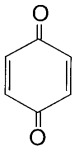
(g) Explain Huckel's rule in your own words.

(4 Marks)

(h) State whether the following compounds are aromatic or non-aromatic and also indicate the number of pi electrons present in each compound.

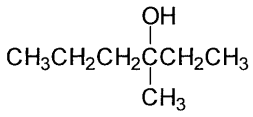
(i) 

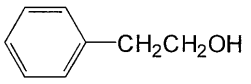
(ii) 

(iii) 

(3 Marks)

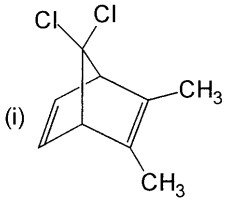
(i) What Grignard reagent and what carbonyl compound might you start with to prepare the following alcohol?

(i) 

(ii) 

(4 Marks)

(j) Draw the structures for dienes and dienophiles to synthesis the following products.

(i) 

(ii) 

(4Marks)

SECTION B:

2. (a) Phenacetin is an analgesic drug. Its IUPAC name is *p*-ethoxyacetanilide. You are given the following reagents. Select the appropriate reagent(s) to synthesise phenacetin from phenol as starting material.

Fe/HCl; CH_3CH_2Cl; nitrating agent; NaH or Na; $(CH_3CO_2)_2O/CH_3COOH$; H_2SO_4; NaOH and any reagent(s) you would like to use, which are not listed.

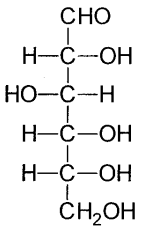
(12 Marks)

(b) Use Fischer projections for the following compounds and identify them as chiral or achiral.

(i) 3-bromo pentane
(ii) 2-chhloro – 2- methyl pentane
(iii) 3-bromo-2-methyl pentane.

(8 Marks)

3. (a) The structure of D – glucose is as follows.



D - GLUCOSE

(i) Draw Haworth projections for D – glucose.

(2 Marks)

(ii) Draw α and β anomers of D – glucopyranose.

(4 Marks)

(iii) Explain with the aid of chair conformation, which isomer is more stable.

(6 Marks)

(b) With the aid of structure(s) explain why phenol is more acidic then ethyl alcohol.

(8 Marks)

4. (a) Discuss S_P^3 hybridisation with an appropriate organic compound of your choice.

(8 Marks)

(b) Starting with benzene as your only source of aromatic compound, how would you synthesise the following compounds? Assume that you can separate isomers if necessary.

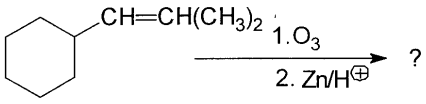
(i) m-bromo nitrobenzene (4 Marks)
(ii) 2-chloro-phenylamine (4 Marks)
(iii) Propylbenzene (4 Marks)

5. (a) Write reaction mechanism for S_N^1 reactions.

(5 Marks)

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

(i) $CH_3CH_2C{\equiv}CCH_3 \xrightarrow{H_2/\text{Lindler catalyst}} ?$

(ii) 

(iii) $CH_3CH_2CH{=}CHCH_2CH_2CH_3 \xrightarrow{\text{alkline } KMnO_4} ?$

(iv) $CH_3CH_2CH_2C{\equiv}CCH_3 \xrightarrow[HgSO_4 \text{ catalyst}]{H_2O/H_2SO_4}$ final product ?

(10marks)

(d) What are the functions of the following spectrometers?

(i) Infra-red spectrometer
(ii) Ultra-violet / visible spectrometer
(iii) 13C NMR spectrometer
(iv) Proton NMR spectrometer
(v) Mass spectrometer

(5 Marks)

********** **END OF QUESTION PAPER** **********