

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED CHEMISTRY

END OF THE SEMESTER EXAMINATIONS – DECEMBER 2005

ORGANIC CHEMISTRY – SCH 1116

FOR SBB, ESH, EFW AND TXT STUDENTS

TIME – THREE(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.
2. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURVED ARROWS.
3. GRAPH PAPER WILL BE PROVIDED ON REQUEST.

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) Write the structural formulae for the following compounds.

- (i) 3-ethyl-2,5-dimethyl heptane
- (ii) 1-chloro-3-ethyl-2-methyl cyclopentane

(2 Marks)

(b) What is plane-polarised light?

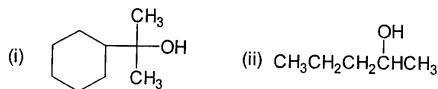
(4 Marks)

(c) Draw E and Z configurations for the following compounds.

- (i) $\text{HOOC}(\text{CHO})\text{C}(\text{CN})(\text{CCH})$
- (ii) $\text{CH}_3\text{CH}(\text{CH}_2\text{OH})\text{CH}_3$

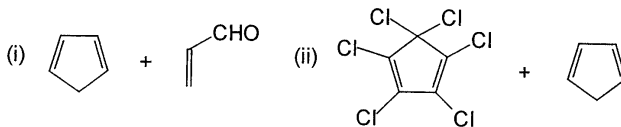
(5 Marks)

(d) What Grignard reagents and what carbonyl compounds might you start with to synthesise the following alcohols.



(4 Marks)

(e) Draw the products of the following Pericyclic reactions.



(2 Marks)

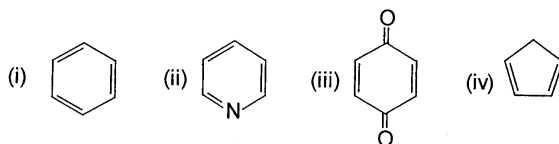
(f) With an appropriate example explain what an α -amino acid is.

(3 Marks)

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

(4 Marks)

(h) State whether the following compounds are aromatic or non-aromatic.



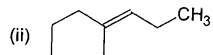
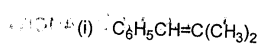
(4 Marks)

(i) Give starting materials and reagents, which would react under basic conditions to give the following ethers.

- (a) ethyl methyl ether
- (ii) dipropyl ether

(6 Marks)

(k) Draw the structures of halides, carbonyl compounds and phosphorus ylides might you use to prepare the following compounds.

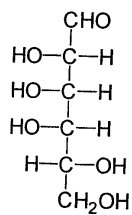


(6 Marks)

SECTION B:

Answer any Three Questions from this section:

2. (a) The structure of D-Talose is as follows.



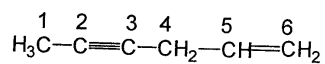
D - TALOSE

- (i) Draw Fischer and Haworth projections for D-Talose. (4 Marks)
- (ii) Draw α - and β - anomers of D-Talopyranose. (4 Marks)
- (iii) Explain with the aid of chair conformation, which isomer is more stable. (6 Marks)

(b) State whether the following statements are true or false. Draw appropriate structures and explain your answer.

- (i) Achiral molecule can have a chiral centre.
- (ii) An optically active substance must be made up of a chiral molecule. (6 Marks)

3. (a) In the following molecule, indicate the kind of hybridisation you might expect for each carbon atom.



- (b) Select any one carbon of your choice from the above compound (indicate which one) and explain in detail the hybridisation. (3 Marks)
- (7 Marks)

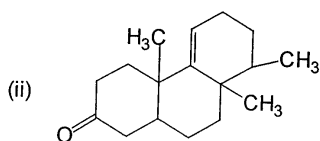
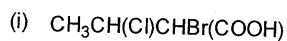
(c) In the reaction of 1-chloropropane with hydroxide ion (HO^-), 1-propanol is formed. 1-propanol does not normally react with chloride ion (Cl^-) but does so in the presence of an acid. With the aid of reaction mechanism explain all the reactions taking place in full. Do these reactions follow $\text{S}_{\text{N}}1$ or $\text{S}_{\text{N}}2$ mechanism.

(10 Marks)

4. (a) Explain with the aid of chemical equations, phenol is more acidic than ethanol.

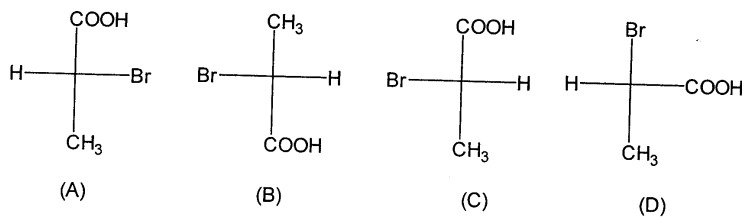
(4 Marks)

(b) Mark with an asterisk (*) all chiral centres present in the following compounds. How many (i) stereoisomers and (ii) enantiomers do you expect from each compound.



(6 Marks)

(c) Assign R or S designation to the following Fischer projections (show your workings). Comment on the relationship between them.

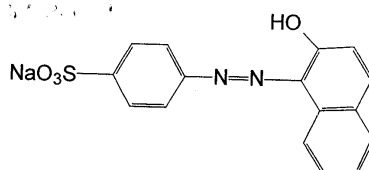


(10 Marks)

5. (a) Acid catalysed dehydration of 1-methyl cyclohexanol yields mixture of products, write reaction mechanism and indicate the major or only product. Give your reason.

(8 Marks)

- (b) How would you synthesise the dye Orange II from benzene and β -naphthol?



- (c) Write chemical equation between alkene and ozone and then with Zn/CH_3COOH and indicate the importance of the reaction. Use alkene of your choice. (No mechanism required). (8 Marks)
- (4 Marks)
6. (a) Starting with benzene as your only source of aromatic compound, how will you synthesise the following compounds? Use reagents of your choice.
- p-chlorophenylamine
 - benzoic acid
- (10 Marks)

- (b) The esters of alcohol E are used in the perfumery industry.

The alcohol with molecular formula $C_6H_5-CH_2CH(OH)CH_3$, exhibits optical isomerism. When treated with hot concentrated H_2SO_4 , each optical isomer of E produces three substances K, L and M, which are isomers of each other. Only small quantity of M is produced. Both K and L reacts with bromine to give 1,2-dibromo-1-phenylpropane (N) whereas M with the same reagent gives 2,3-dibromo-1-phenylpropane (P).

- Suggest structures of E, K, L and M. (4 Marks)
- Indicate the type of isomerism shown in compounds K, L and M. (2 Marks)
- Write chemical steps of the reaction from E to K to N (no mechanism required). (3 Marks)
- What products would you formed when K reacts with cold $KMnO_4$? Write the chemical structure for the product. (1 Marks)

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