

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTEMENT OF APPLIED CHEMISTRY

END OF SEMESTER EXAMINATIONS – DECEMBER 2002

ORGANIC CHEMISTRY – SCH 1221

(FOR CHEMICAL ENGINEERING STUDENTS)

TIME – THREE 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.

GRAPH PAPER WILL BE PROVIDED ON REQUEST.

TOTAL MARKS = 100

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

SECTION A

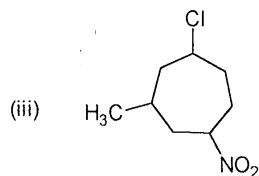
1. (a) Write structural formulae for the following compounds.

- (i) 2,2-dimethyl-4-propyl octane
- (ii) trans-1,3-dichlorocyclohexane
- (iii) (S)-3-methylhexane

(3 Marks)

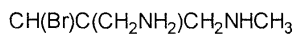
(b) Give IUPAC names for the following compounds.

- (i) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$
- (ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_2\text{CH}_2\text{CH}_3$



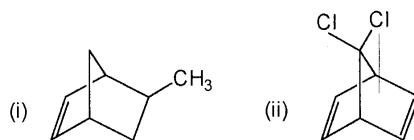
(3 Marks)

(c) Assign E and Z configurations for the following alkene. Indicate priority on the structure.



(3 Marks)

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

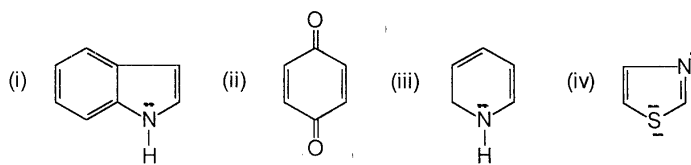


(4 Marks)

(e) Define Huckel's rule in your own words.

(4 Marks)

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



(4 Marks)

(g) What information does the expression below give?

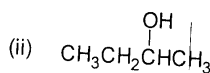
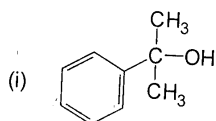
$$\left[\alpha \right]_D^{25} = -3.7^\circ$$

(5 Marks)

(h) With an appropriate example(s) explain functional isomers.

(4 Marks)

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



(4 Marks)

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

1-chloro-3-methyl cyclohexane

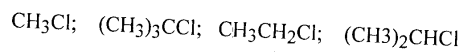
(6 Marks)

SECTION B:

2. (a) With an appropriate example (organic compound) of your choice explain sp hybridisation. Draw the orbital and bonded structure. What will be the shape of the compound?

(8 Marks)

(b) List the following alkyl halides in order of decreasing S_N2 reactivity with the nucleophile HO^- .



Write reaction mechanism for S_N2 reaction and justify the order you have suggested.

(8 Marks)

(c) Draw and label all possible Newman projections for 1,2-dibromoethane.

(4 Marks)

3. (a) Predict the product(s) of the following reactions and provide IUPAC names for the product(s). (No mechanism required).

- (i) Propene and hydrogen bromide in presence of peroxide.
- (ii) Reduction of pent-2-yne with Lindler catalyst.
- (iii) Oxidation of hex-2-ene with ozone.

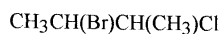
(10 Marks)

(b) Dehydrohalogenation of 2-bromo-2-methyl butane with sodium hydroxide in ethanol yields a mixture of products.

- (i) Write reaction mechanism for the reaction
- (ii) State which product would predominate? Give your reason.

(10 Marks)

4. (a) Assign R and/or S configurations to the following compound. Show the necessary steps.



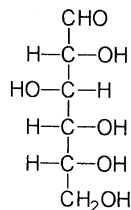
(4 Marks)

(b) Starting with benzene as your only source of aromatic compound, how will you synthesise the following compounds? Use reagents of your choice.

- (i) *p*-bromoaniline
- (ii) *o*-chlorophenol
- (iii) butylbenzene

(16 Marks)

5. (a) The structure of D- glucose is as follows:



D - GLUCOSE

- (i) Draw α and β anomers of D-glucopyranose.

(4 Marks)

- (ii) Comment with the aid of the chair conformations, on the stability of the anomers.

(6 Marks)

(b) The reaction between hex-3-ene and alkaline potassium permanganate produces dihydroxy hexane. This product is an optically active compound. Use Fischer projection to draw as many stereoisomers of the product as possible and label them as enantiomers, diastereoisomers and meso compound.

(10 Marks)

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