



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ORGANIC CHEMISTRY II (For SCH Students Only)

SCH 1202

Second Semester Examination Paper

May 2016

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiner's Name: Dr. B. N. Yalala

INSTRUCTIONS

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. Start new question on a new page (not each part of a question).
3. Show mechanism, chemical steps or synthesis by means of curved arrows.

MARK ALLOCATION

QUESTION	MARKS
1	40
2.	20
3.	20
4.	20
5	20
TOTAL POSSIBLE MARKS	100

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SCH 12026

SECTION A:

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

(4 Marks)

(b) Account for the fact that an amido substituent (-NHCOR) is ortho- and para- directing, by drawing resonance structures that share the nitrogen lone pair electrons with the aromatic ring.

(6 Marks)

(c) Explain why benzaldehyde is less reactive in nucleophilic addition reactions than an aliphatic aldehyde?

(2 Marks)

(d) Rank the following compounds in order of increasing acidity:

(i) Benzoic acid, p-Methylbenzoic acid, p-Chlorobenzoic acid

(ii) p-Nitrobenzoic acid, acetic acid, benzoic acid.

(4 Marks)

(e) Define these terms in your own words:

(i) Aromaticity

(ii) Conjugated

(iii) Huckel ($4n + 2$) rule

(iv) Resonance hybrid

(8 Marks)

(f) Show how carbonyl compounds can exist in the enol-form and as an enolate ion which leads to alpha (α) substitution reaction.

(4 Marks)

(g) Draw structures corresponding to these IUPAC names:

(i) 2,3-Dimethylhexanoic acid

(ii) 4-Chloro-2-pentanone

(iii) Triethylamine

(iv) 4-Ethyl-2-propyloctanoic acid

(8 Marks)

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(h) Acetic acid boils at 118°C, but its ethyl ester boils at 77°C. Why is the boiling point of the acid so much higher, even though it has the lower molecular weight?

(2 Marks)

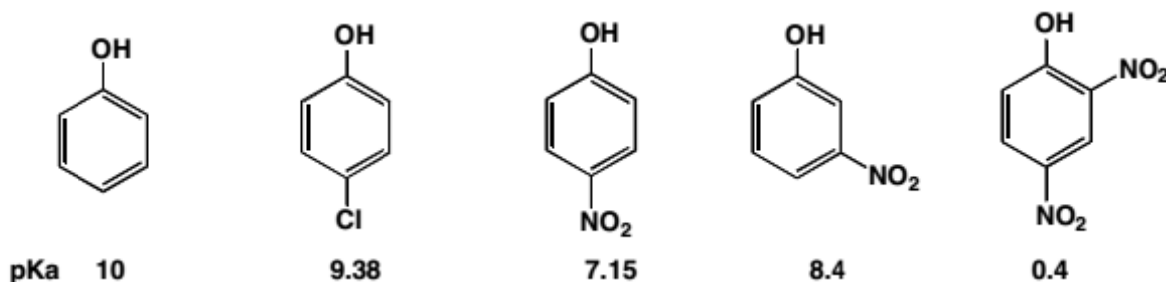
(i) What do you understand by mixed aldol condensation reaction?

(2 Marks)

SECTION B:

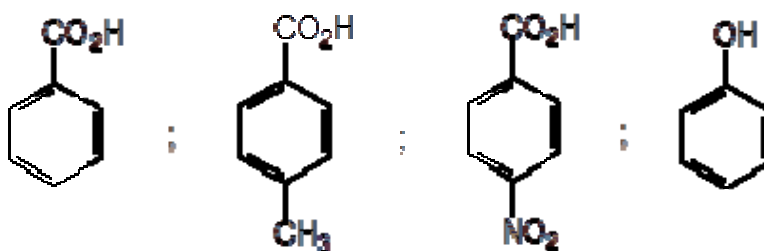
2. (a) Below are listed five different phenols and the pKa values of their phenolic -OH protons. Explain why the pKa values are so different using resonance and inductive effect arguments (AND DRAWING STRUCTURES TO ILLUSTRATE THESE) as necessary.

(5 Marks)



Hint -write out the full structure of the -NO₂.

(b) With brief explanations, arrange the following compounds in order of increasing acidity:

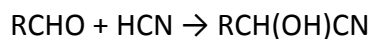


(5 Marks)

(c) While 2,2-dimethoxypropane may be viewed as an ether, it is rapidly hydrolysed to methanol and acetone in dilute aqueous acid. However, diethyl ether and 1,2-dimethoxypropane are stable in this medium. Account for this difference and provide a mechanism for the acid-catalysed hydrolysis of 2,2-dimethoxypropane.

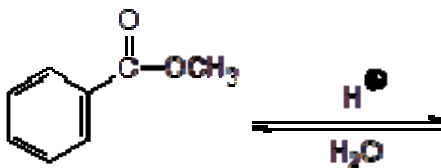
(10 marks)

3. (a) Suggest the mechanism for the following reaction.



(4 Marks)

(b) Both imine and enamine formation are reversible. Show all of the steps involved in the hydrolysis of an enamine.



(6 Marks)

(c) With the aid of chemical reactions explain the major difference(s) between (i) Friedel-Crafts alkylation and (ii) Friedel-Crafts acylation reactions.

(10 Marks)

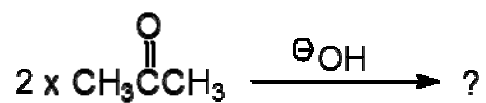
4. (a) Can you propose a mechanism to account for the methylation of benzene by CH_3Cl and AlCl_3 catalyst?

(5 marks)

(b) Outline the synthesis of *o*-chlorobenzoic acid from benzene. Use reagents of your choice.

(5 marks)

(c) Write the reaction mechanism for the following reaction and suggest the type of reaction that has taken place.



(5 marks)

(d) Propose a mechanism for the synthesis of salicylic acid (*o*-hydroxybenzoic acid) using phenol as the starting material.

(5 marks)

5. (a) Propose a mechanism for the preparation of phenol using the cumene route, and starting with benzene.

(20 marks)

END OF QUESTION PAPER

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