



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 2017

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Examiner's Name: Mr. A. Ndiripo

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.

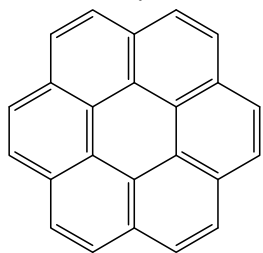
MARK ALLOCATION

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

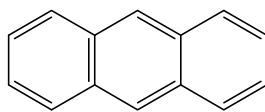
SECTION A

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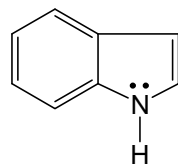
1. a) Name four criteria which must be satisfied by an organic compound for it to be aromatic. [4 Marks]
- b) State which of the following compounds is aromatic or non-aromatic. Indicate the number of pi electrons in each compound.



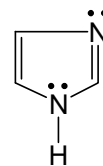
(i)



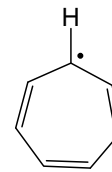
(ii)



(iii)



(iv)



(v)

[10 Marks]

- c) Draw structures corresponding to these IUPAC names:

- (i) *tert*-Butylbenzene
 (ii) 4-Chloro-1-nitro-2-propylbenzene
 (iii) 4-Chloro-2-pentanone

[6 Marks]

- d) Account for the aromaticity of the Cyclopentadienyl anion.

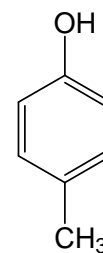
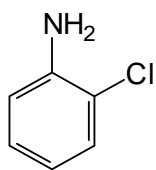
[4 marks]

- e) Define these terms in your own words:

- (i) Conjugated
 (ii) Resonance structures

[4 Marks]

- f) Copy the following structures and illustrate with the aid of arrows where the incoming group will be directed.



[4 Marks]

- g) With an appropriate example, explain the following terms

- (i) α -amino acid
 (ii) Zwitterion

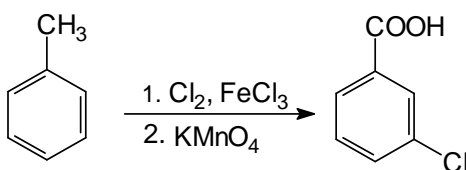
[4 Marks]

- h) Outline the synthesis of Benzene sulfonic acid from Benzene. (No mechanism required).
 Give two uses of Benzene sulfonic acid.

[4 Marks]

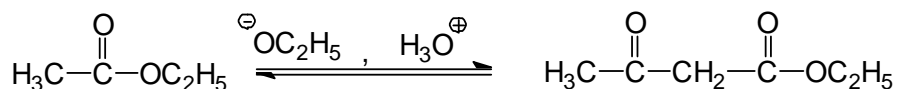
SECTION B

2. a) Discuss briefly three pieces of evidence which support the stability of Benzene. [6 Marks]
- b) (i) Outline the synthesis of Nitrobenzene from Benzene (give a reaction mechanism). [4 Marks]
- (ii) Give reaction conditions under which Nitrobenzene is converted to Phenyl amine. [2 Marks]
- c) In the following reaction, the synthetic routes are not correct. How would you correct the route(s) to obtain the given product? (No mechanism required).

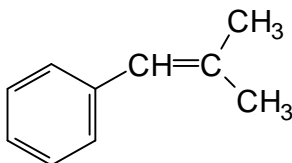


- [2 Marks]
- d) Propose a mechanism to account for the methylation of Benzene by CH_3Cl and AlCl_3 catalyst. [4 Marks]

3. a) Suggest the mechanism for the following Claisen condensation reaction.

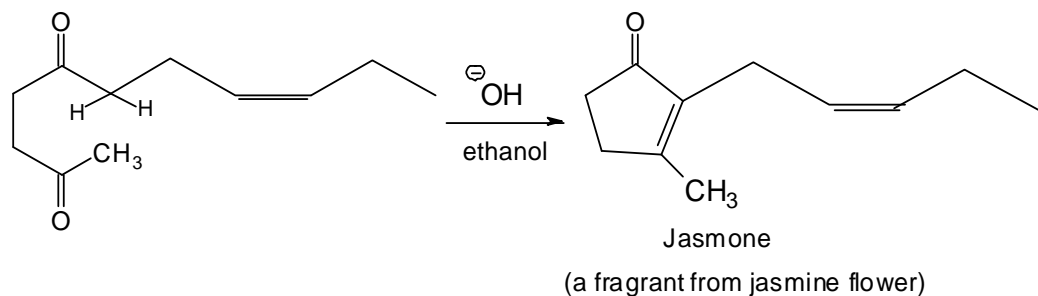


- [5 Marks]
- b) Draw the structures of an ylide and a carbonyl compound from which the following compound can be prepared.



Outline the possible synthesis of the ylide starting from Triphenyl-phosphine, a suitable alkyl halide and the reaction mechanism for the product. [10 Marks]

- c) Jasnone is an organic compound, which is a volatile portion of the oil from Jasmine flowers. It is a colourless to pale yellow liquid and a cyclic enone that is prepared through internal aldol reaction from the compound shown in the reaction scheme below. Write a reaction mechanism for the reaction. The mechanism should not take more than five steps.



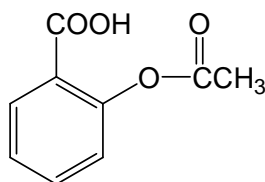
[5 Marks]

4. a) Friedel-Crafts alkylation has limitations. State them and give one example of each.

[8 Marks]

- b) Aspirin is an analgesic drug. It is widely used for pain and fever. It is synthesized from phenol. Its structure is shown below. Write a reaction mechanism for the synthesis of aspirin from phenol. Use reagents of your choice. Give the name of one of the steps that take place during the reaction.

[6 Marks]



- c) Given the following list of substituents:

-CHO; -NO₂; -OCH₃; -COOH; -Br

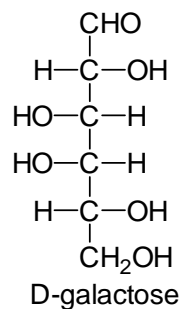
Indicate the substituents which are:

- (i) ortho/para directing with activation
- (ii) ortho/para directing with deactivation
- (iii) meta-directing with deactivation

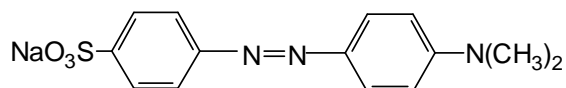
with respect to electrophilic substitution reactions in benzene derivatives. (A mark will be deducted for the wrong answer).

[6 marks]

5. a) Given the following monosaccharide:



- (i) Suggest why D-galactose is dextro-rotatory. [1 Mark]
(ii) Draw Fischer and Haworth projections for D-galactose. [2 marks]
(iii) Draw α - and β -anomers of D-galactopyranose. [4 marks]
- b) Methyl orange is an azo dye that is widely used as a pH indicator.



- Draw the two structures which couple together and indicate the reaction conditions needed for the reaction. [3 Marks]
- c) Explain, with the aid of chemical equations, why
- (i) Phenol is more acidic than ethanol
(ii) Trifluoroacetic acid is more acidic than acetic acid [10 Marks]

End of Examination!!!!