



# 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 2015

This examination paper consists of 6 printed pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Special Requirements: None**

**Examiner's Name: Dr C T Parekh**

## 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

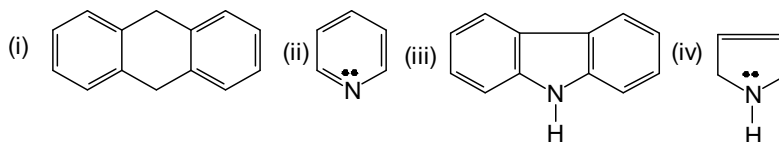
QUESTION	MARKS
1	40
2.	20
3.	20
4.	20
5	20
<b>TOTAL POSSIBLE MARKS</b>	<b>100</b>

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SCH 1202

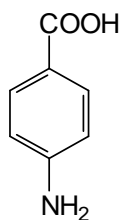
### SECTION A:

1. (a) Suggest four criteria which indicate that benzene is a very stable compound. (4 Marks)
- (b) Draw isomeric structures for the molecular formula  $C_7H_7NH_2$  and give their IUPAC names. (4 Marks)
- (c) Explain Huckel's rule in your own words. (4 Marks)
- (d) State whether the following compounds are aromatic or non-aromatic and also indicate the number of pi electrons present in the compounds.



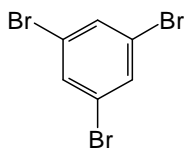
(8 Marks)

- (e) trans-(e,e)-1,4-dichloro cyclohexane is more stable than its trans-(a,a)-isomer. Explain this observation with an appropriate chair confirmation. (4 Marks)
- (f) Explain with the aid of chemical equations, why phenyl amine is less basic than ethylamine. (4 Marks)
- (g) Show how carbonyl compounds can exist in the enol-form and as an enolate ion which leads to alpha ( $\alpha$ ) substitution reaction. (4 Marks)
- (h) *p*-amino benzoic acid (PABA) is widely used as a sunscreen agent. Propose a synthesis of PABA starting from methylbenzene. Use reagents of your choice. (No mechanism required).



(4 Marks)

- (i) Propose the synthesis for the following compound from phenylamine. (No mechanism required)



(4 Marks)

- (j) With an appropriate example, explain what is an  $\alpha$ -amino acid? (4 Marks)

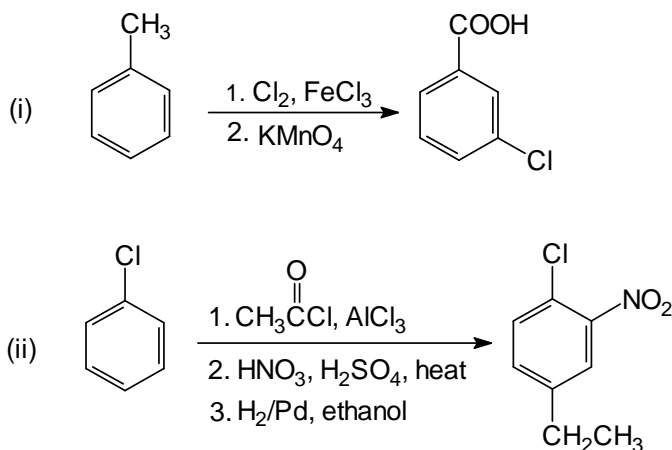
**SECTION B:**

2. (a) Benzene, pyrrole and pyridine are aromatic compounds. Explain with example/s why?

- (i) benzene and pyrrole undergo electrophilic substitution reaction with ease while pyridine does not and
- (ii) mono-substituted pyridine undergoes nucleophilic substitution with ease while benzene and pyrrole do not.

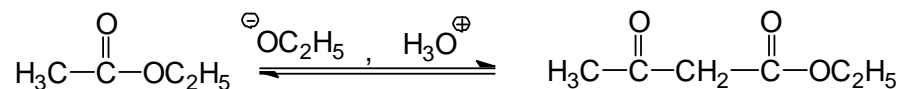
(10 Marks)

(b) As written, the following syntheses have certain flaws. What is wrong with each one? Suggest the correct steps to produce the products. (No mechanism required).



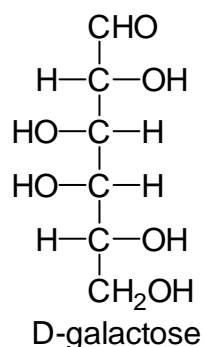
(10 Marks)

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

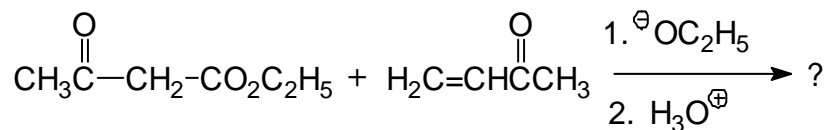


(5 Marks)

(b) You are given the following monosachharide:



- (i) Draw its Fischer projection. (1 Mark)
- (ii) Draw its Haworth projection and indicate the type of reaction involved. (3 Marks)
- (iii) Write the Kiliani-Fischer synthesis (chain lengthning) for D-galactose. For this reaction you may need HCN, acidic solution and reducing agent. (No mechanism required). (3 Marks)
- (iv) What will be the products when D-galactose reacts with:  
(i) reducing agent such as sodium borohydride and  
(ii) oxidizing agent such as nitric acid. (2 Marks)
- (c) Write the reaction mechanism for the following Michael reaction. (2 Marks)



(6 Marks)

4. (a) You are given the following list of substituents:

-CHO; -Cl; -OH; -NO<sub>2</sub>; -OCH<sub>3</sub>; -COOH; -Br; -NHCOCH<sub>3</sub>; -SO<sub>3</sub>H; -C<sub>6</sub>H<sub>5</sub>

Indicate the substituents which are:

- (i) o/p directing with activation  
(ii) o/p directing with deactivation  
(iii) m-directing with deactivation

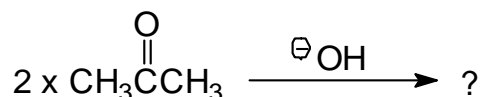
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With respect to electrophilic substitution reactions in benzene derivatives.  
(Mark will be deducted for the wrong answer).

(10 Marks)

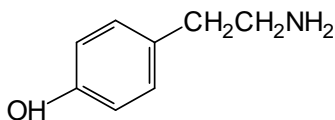
(b) Why is a  $\text{-NHCOCH}_3$  group substituted to benzene ring found to be moderately *o*- and *p*- directing compared to a  $\text{-NH}_2$  group substituted to benzene ring which is highly reactive and forms 2,4,6- substituted product? (5 Marks)

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



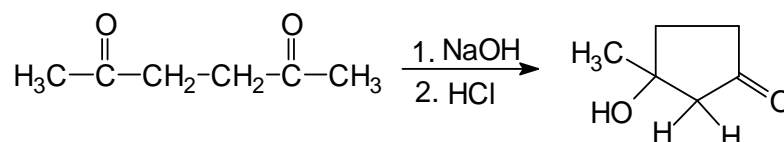
(5 Marks)

5. (a) Tyramine is an alkaloid found, among other places, in mistletoe and ripe cheese. How would you synthesise tyramine from benzene. You are provided with the following reagents;  $\text{AlCl}_3$ ,  $\text{CH}_3\text{Cl}$ ,  $\text{SO}_3/\text{H}_2\text{SO}_4$ ,  $\text{NaOH}$  solution, acidic solution, Bromine,  $\text{NaCN}$ , reducing agent such as  $\text{LiAlH}_4$ ,  $\text{H}_2\text{O}$ , peroxide or UV radiation lamp and any other reagents you may need. (No mechanism required).



(7 marks)

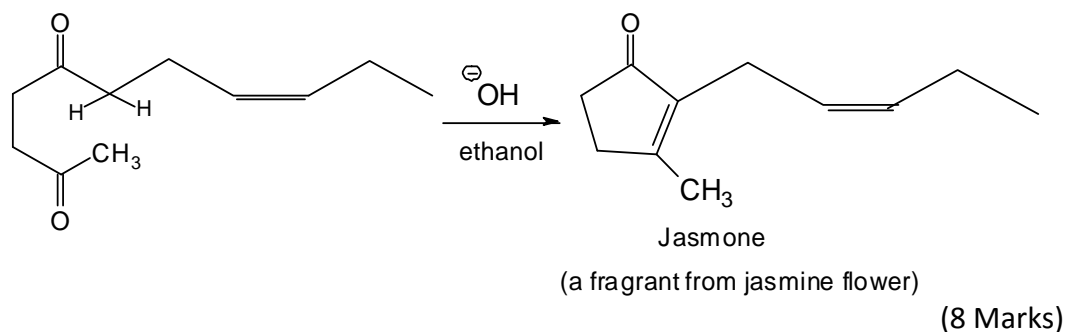
(b) Write the reaction mechanism for the following reaction.



(5 marks)

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- (c) Jasmone, a fragrant from jasmine flower, is a cyclic enone and is prepared through internal aldol reaction from the compound shown below. Write the reaction mechanism for the reaction. The mechanism should not take more than five steps.



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