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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF BIOLOGICAL & PHYSICAL SCIENCES**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF EDUCATION SCIENCE WITH IT**

**4th YEAR 2nd SEMESTER 2016/2017 ACADEMIC YEAR**

**REGULAR**

**COURSE CODE: SCH 405**

**COURSE TITLE: SYNTHETIC ORGANIC CHEMISTRY**

**EXAM VENUE: AUDITORIUM STREAM: (BEd. Science)**

**DATE: 23/12/16 EXAM SESSION: 2.00 – 4.00 PM**

**TIME: 2.00 HOURS**

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**Instructions**

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION ONE (30 MARKS)**

1. Define the term synthesis and outline eight of its importance (6 marks)
2. In electrophilic aromatic substitution, what do you understand by the following:

(4 marks)

1. Activating groups
2. Deactivating groups
3. State five factors that need to be taken into account when designing a synthetic scheme. (5 marks)
4. Differentiate between a synthon and a synthetic equivalent in organic synthesis? (2 marks)
5. Differentiate between Friedel-Crafts alkylation and Friedel-Crafts acyclation reactions and show an example of an alkyl and an acyl group. (4 marks)
6. Synthesis can be carried out either in a linear or convergent manner. Give a brief description of each stating their advantages and disadvantages. (6 marks)
7. Amines are organic compounds that are derived from ammonia (NH3). Name three methods by which they can be synthesized. (3 marks

**QUESTION TWO (20 MARKS)**

1. Define the term retrosynthesis and explain the process involved in retrosynthetic analysis in organic synthesis. (6 marks)
2. Epoxides are important intermediates in organic synthesis. (4 marks)
   1. Give a brief description of what epoxides are.
   2. Complete the following epoxidation reaction for compound A by showing the reagent B and product C which is a diepoxide



1. Explain what an aldol condensation reaction is and give the resultant products of the following reactions: (6 marks)
   1. 
   2. 
2. Explain what you understand by asymmetric synthesis and name two strategies by which it may be achieved. (4 marks)

**QUESTION THREE (20 MARKS)**

1. Carry out the retrosynthetic analysis of the following molecules: (9 marks)
   1. 
   2. 
   3. 
2. Using acetaldehyde (**2**) explain the generally accepted mechanism for base-catalyzed aldol condensation reaction. (6 marks)



1. What is the name of a reagent that selectively attacks a particular functional group? (1 mark)
2. Primary alcohols can be made into aldehydes through an oxidation reaction. One of the reagents for this process is pyridinium chlorochromate (PCC) in methylene chloride (CH2Cl2) as the solvent:
   1. why should water not be present? (1 mark)
   2. Why is PCC a common ingredient in kits that are designed to allow drug users to pass urinalysis tests? (2 marks)
3. What is an organometallic compound? (1 mark)

**QUESTION FOUR (20 MARKS)**

1. Epoxides are highly strained and to relieve the strain they may be broken down using other reagents like water. Using curly arrows explain how the epoxide molecule below can be opened in the presence of water. (8 marks)



1. With a general example describe what a Grignard reagent is and illustrate how it can be formed? (4 marks)
2. Show the two possible routes for the retrosynthetic analysis of the compound below (4 marks)



1. Complete the following Wittig reactions by showing the missing reagents, intermediates or products as indicated by the letters A, B, C and D: (4 marks)
   1. 
   2. 

**QUESTION FIVE (20 MARKS)**

1. Given molecule **1** as the target molecule for synthesis, carry out its retrosynthetic analysis and show which synthetic equivalents would be used to achieve its synthesis (use equations) (6 marks)



1. Give FIVE advantages of carrying out retrosynthetic analysis before carrying out a synthesis. (5 marks)
2. Give a brief explanation of what a Wittig reaction with an illustration of how an ylide and a betaine is formed. (5 marks)
3. Define keto/enol tautomerism and give an illustration and explanation of the same using the molecule below by indicating which between a and b is either an enol or keto? (4 marks)

