KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE) AND BCH

COURSE CODE: SCH 312/313

COURSE TITLE: ORGANIC SYNTHESIS

DATE: 24/05/2022 **TIME:** 9:00AM-11:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

Question 1 (30 marks)

a) Define the following terms as used in Organic synthesis [3 marks]

i). Synthon

ii). Synthetic equivalent

iii). Retrosynthesis

b) State the guidelines to good disconnections of a target molecule when designing a synthetic route [4 marks]

c) State and explain three factors to consider when planning for an organic synthesis. [3marks]

d) i) Name four general organic reactions [2 marks]

ii). Describe one of the four organic reactions and give a general mechanism. [3 marks]

iii). Give an equation in which butanal is reduced to butanol [5 marks]

e) 2-heptanone is responsible for the peppery odor in some cheese. You have been asked to synthesize it.

i). Show how you arrive at the starting material. [3 marks]

ii). Show how you synthesize 2-heptanone using the starting materials you identified in d(**i**) above. [4 marks]

f) Give any three applications of organic synthesis [3 marks]

Question 2 (20 marks)

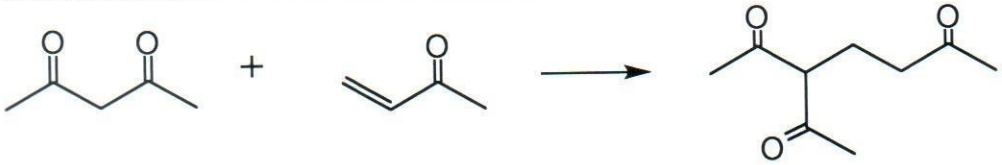
a) i). What is an aldol condensation reaction? [2 marks]

ii). By use of curly arrows, provide a plausible mechanism for the following transformation [6 marks]

b) i). What is a Michael reaction? [2 marks]

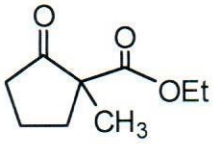
ii). Give four requirements for a Michael reaction to occur. [4 marks]

iii). Give a mechanism for the reaction below. [6 marks]



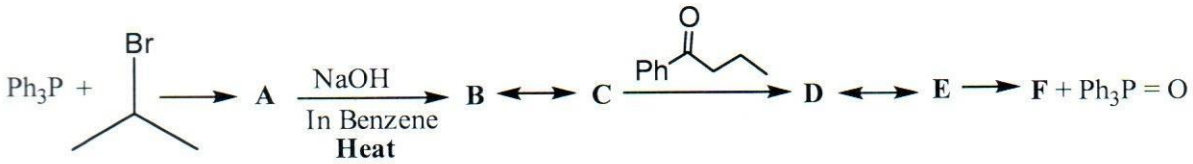
Question 3 (20 marks)

a) Provide a synthesis of 2-methyl-2-carboethoxycyclopentanone starting with acylic precursors using a Dieckmann cyclization as a key carbon-carbon bond forming step. Show all reagents and intermediate structures. [4 marks]

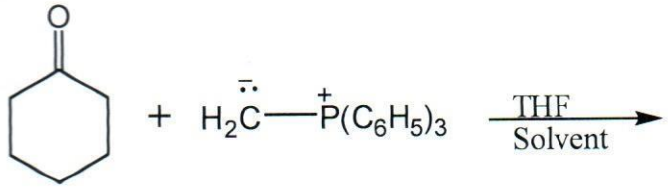


b) When 2,6-heptanedione is heated in the presence of aqueous sodium hydroxide, a condensation product with a six-membered ring is obtained. Draw the product and show a mechanism for its formation. [5 marks]

c) Suggest the structures A, B, C, D, E and F in the following reaction sequences.[6 marks]

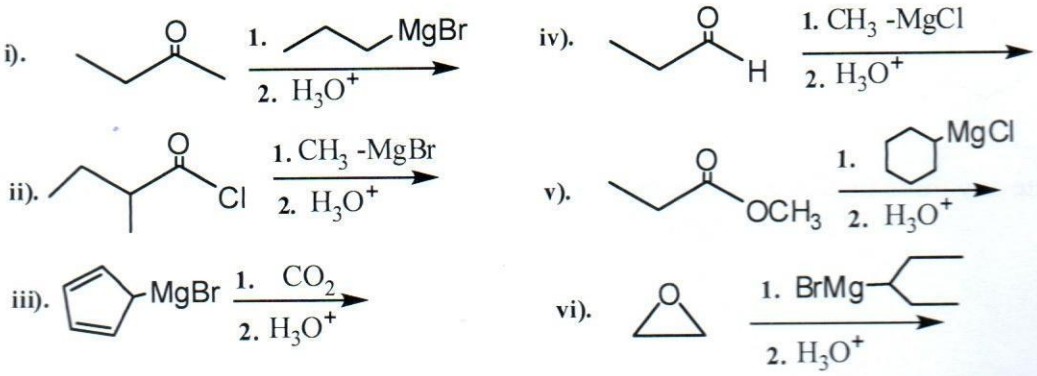


d) In the Wittig reaction, a phosphorus ylide adds to a ketone or aldehyde to yield an alkene. Write the complete stepwise mechanism for the Wittig reaction shown below. Show all the intermediate structures and all electron flow with curly arrows. [5 marks]



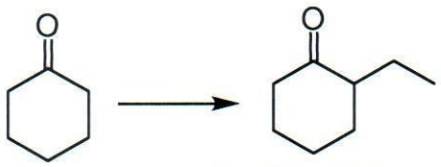
Question 4 (20 marks)

a) Grignard reagents are formed by the reaction of magnesium metal with alkyl or alkenyl halides. They're extremely good nucleophiles, very strong bases and will react with acidic hydrogens. Provide the products formed in the reactions shown below.



[12 marks]

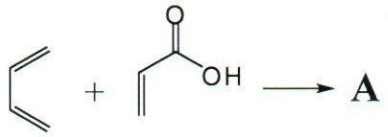
b) Provide a plausible mechanism for the synthesis of 2-methylcyclohexanone using the *Stork Enamine* alkylation reaction. [8 marks]

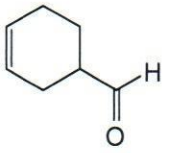


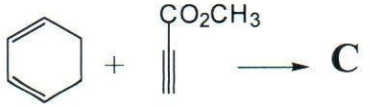
2-ethylcyclohexanone

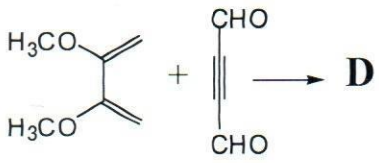
Question 5 (20 marks)

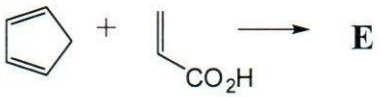
a) For each of the following Diels-Alder reactions, fill in either the appropriate final product or necessary starting materials [8 marks]

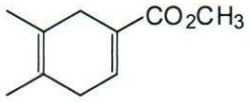
i). 

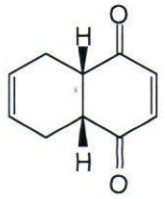
ii). **B** 

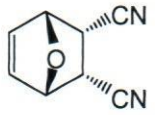
iii). 

iv). 

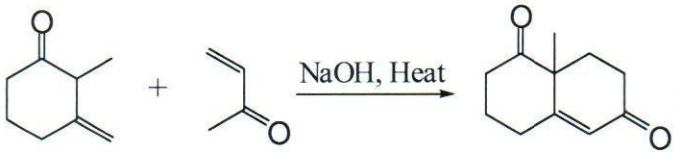
v). 

vi). **F** 

vii). **G** 

viii). **H** 

b) Suggest the reaction mechanism for the following transformation [9 marks]



c) State any three factors essential in choosing protecting groups in organic synthesis [3 marks]