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University Examinations 2023/2024

SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

SCH 3252: ORGANIC CHEMISTRY II

DATE: APRIL 2024 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Define the following terms (2 marks)

i) Alky halide

ii) reaction mechanism

b) Using suitable examples, distinguish between (8 marks)

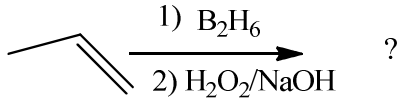
i) Vicinal and germinal alkyl halides

ii) Substitution and elimination reactions

iii) electrophile and nucleophile

iv) protic and aprotic solvents

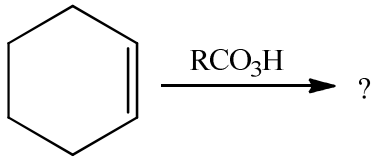
c) Complete the reactions below, by providing the product formed or reagent required (6 marks)

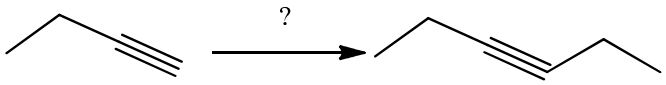
i) 

ii) $2CH_3CH_2Br + 2Na \longrightarrow$?

iii) $C(CH_3)=CHCH_3 \xrightarrow[Zn/H_2O]{O_3}$?

iv) $CH_3CH=CH_2 + HBr \xrightarrow{ROOR}$

v) 

vi 

d) State

i) Markovnikov's rule

ii) Sayzteff's rule (2 marks)

e) (i) Draw two constitutional isomers of C_2H_6O. (ii) Which isomer has the higher boiling point? Explain and make a careful drawing to illustrate your answer (3 marks)

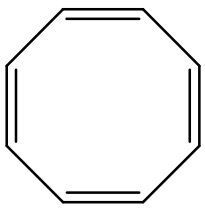
f) Explain the following observations

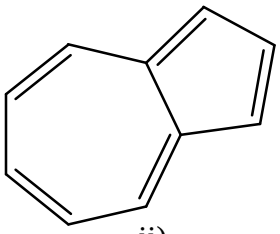
i) Alkyl halides are insoluble in water (2 marks)

iii) phenols are more acidic than alcohols. (2 marks)

iv) Para isomers are of higher melting points as compared to their ortho and meta isomers (2 marks)

g) Classify the following molecules i), ii) and iii) as aromatic, non-aromatic and antiaromatic (3 marks)


i)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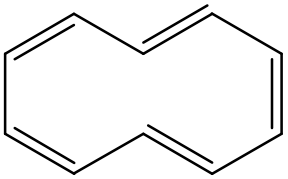

iii)

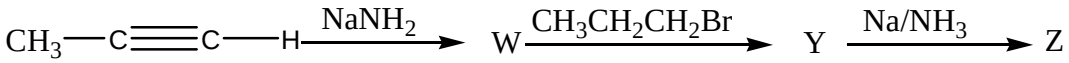
QUESTION TWO (20 MARKS)

a) Explain the following observations

i) alcohols have higher boiling points than ethers and hydrocarbons of similar molecular weights (2 marks)

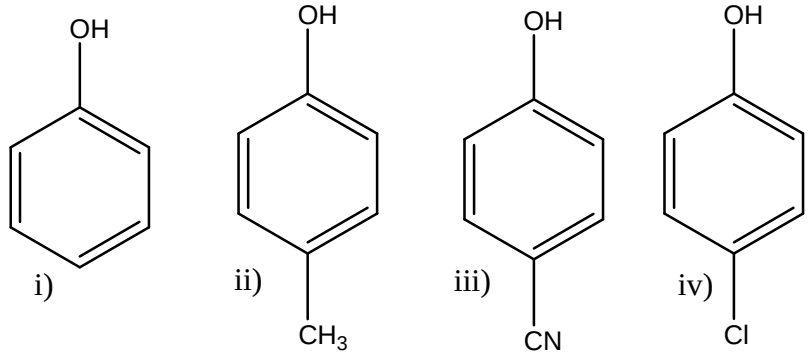
ii) aldehydes are more reactive than ketones. (2 marks)

b) Complete the chemical transformations by providing the products W, Y and Z (3 marks)



c) Explain two characteristics of the double bond that help us understand why addition reactions occur on alkenes (2 marks)

d) I) Arrange the following molecules in decreasing acidic order (1 mark)



ii) Explain your answer in (i) above (5 marks)

e) Using the reaction between methyl bromide (CH_3Br) and a strong base (OH– ion of NaOH), illustrates how S_N1 or S_N2 reaction occurs. . (5 marks)

QUESTION THREE (20 MARKS)

a) Draw the structure of the following molecules

i) (Z)-2-bromo-3-chloro-2-pentene ii) (E)-5-Chloro-3- methyl-3-pentene. (2 marks)

b) State three criteria of aromaticity. (3 marks)

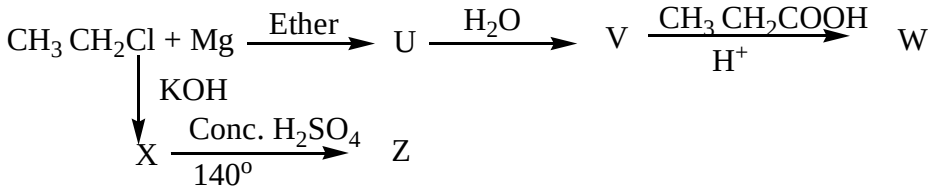
c) Explain the following observations;

i) Alkenes undergoes electrophilic addition reaction whereas carbonyl compounds undergo nucleophilic addition. (2 marks)

ii) Phenol is more reactive than benzene towards electrophilic reagents (2 marks)

d) Write the reaction mechanism showing Friedel-Crafts acylation (6 marks)

e) Study the scheme below and draw the structures of the products formed U, V, W, X and Z



(5 marks)

QUESTION FOUR (20 MARKS)

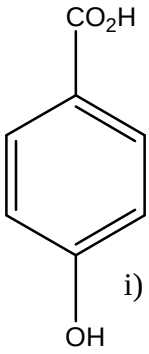
a) Distinguish between Chemoselectivity and Regioselectivity (2 marks)

b) Benzene does not decolourize bromine water, but when a piece of iron is added, it immediately decolorizes bromine water giving a compound A.

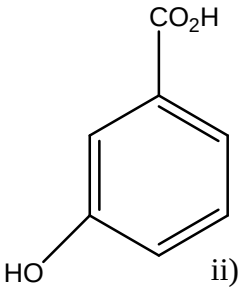
i) Explain the observation (2 marks)

ii) Write the reaction mechanism leading to formation of compound A (6 marks)

c) Arrange the following compounds in the order of acidity and explain your answer.



i)



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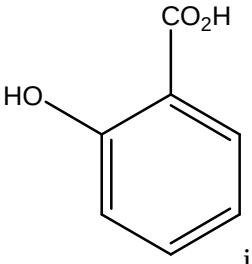

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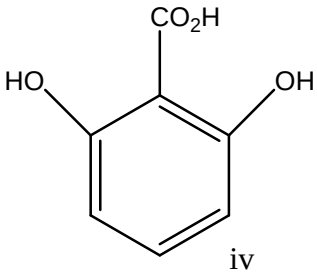

iv

4 marks)

d) Discuss the orientation and reactivity of benzene ring to electrophilic aromatic substitution (6 marks)