

E-CHEMISTRY SELF TUTORIALS FOR ADVANCED LEVEL

9. (a) (i) State Markonikov's Rule. -----

(ii) Write the equation for the reaction between propene, $\text{CH}_3\text{CH}=\text{CH}_2$ and hydrogen bromide, HBr , in the presence of an organic peroxides. -----

2 marks

(b) Propene and ethyne, ($\text{HC}\equiv\text{CH}$), are both unsaturated hydrocarbons

(i). How would you test for the presence of unsaturation in the two compounds? -----

(ii). Giving reagents, reaction conditions and products, describe how you would distinguish chemically between propene and ethyne. -----

4 marks

(c) The carboxylic acid, $\text{CH}_3\text{CO}_2\text{H}$, and the aldehyde, CH_3CHO , both undergo condensation reactions

(i). What is a condensation reaction? -----

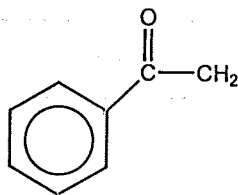
(ii). Write an equation to illustrate the condensation reaction for each of them. -----

3 marks

(d) The acylation of benzene is an *electrophilic substitution* reaction

(i). Identify the electrophile in the reaction -----

(ii). Write out the equation, including reagents and conditions, for the acylation of benzene to produce acetophenone



(iii). Outline the mechanism of the reaction. -----

5 marks

(c) Halogenoalkanes undergo both substitution and elimination reactions. Write an equation (stating reagents, reaction conditions and products), using 1-iodopropane $\text{CH}_3\text{CH}_2\text{CH}_2\text{I}$ to illustrate one of their

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(i). Substitution reactions -----

(ii). Elimination reactions -----

4 marks

(f) Grignard reagents are useful for synthesis of organic compounds.

(i). Write an equation for the preparation of a Grignard reagent. -----

(ii). What important precaution must be taken during its preparation? -----

2 marks

SET 7: SECTION B (CGCEB 2015)

Organic Chemistry

5. (a) State the information about the structure of an organic compound that can be revealed by the following spectroscopic techniques.

Spectroscopic method	Information obtained
Mass spectroscopy	
Infra-red spectroscopy	
NMR spectroscopy	

3 marks

b) An organic compound contained 48.7 percent of carbon and 8.1 percent of hydrogen. Determine its empirical formula.

3 marks

c) Using suitable examples in each case state the difference between an electrophile and a nucleophile.

4 marks

d) Nitrobenzene is obtained by reacting benzene with a nitrating mixture.

i) Give the composition of the nitrating mixture.

ii) What is (are) the condition(s) of the reaction?

iii) State and illustrate the mechanism of the nitration of benzene.

5 marks

c) (i) What is atomic hybridisation?

ii) Explain the difference in shape between methane (CH_4) and ethene (C_2H_4).

5 marks

6. (a) The compound $\text{C}_4\text{H}_{10}\text{O}$ exhibits isomerism.

i) What is isomerism?

ii) Give the structures of two isomers of $\text{C}_4\text{H}_{10}\text{O}$ in each case that show

A. Position isomerism

B. Optical isomerism

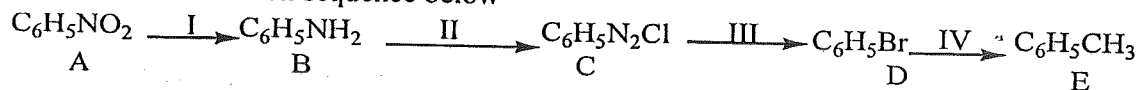
C. Functional group isomerism

D. Chain isomerism

iii) Give a chemical test to distinguish between the functional group isomers given above.

7 marks

b) Consider the reaction sequence below



i) Give the names of compound B and C

B: _____

C: _____

ii) State the reagent and the reaction conditions represented by I to IV

I. _____

II. _____

III. _____

IV. _____

iii) How would you convert compound C to an azo dye? _____

iv) Explain how you would obtain compound B from the reaction mixture. -----

13 marks

SET 8: SECTION B (CGCEB 2016)

Organic Chemistry

5. (a) A sample of aspirin (acetylsalicylic acid) of molecular weight 180, on analysis was found to contain 60% carbon, 4.4 % hydrogen and 35.6% oxygen (RAM: C = 12, H = 1, O = 16).

(i) Determine the empirical formula of aspirin? -----

(ii) What is the molecular formula of aspirin? -----

(iii) State the technique that can be used to determine the molecular weight of aspirin -----

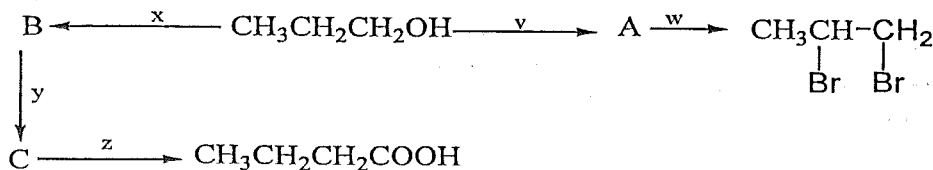
5 marks

(b) (i) Give the structures of all the isomers of a compound with molecular formula $C_3H_6Cl_2$ -----

(ii) Which structure(s) in 5b(i) is (are) optically active? -----

5 marks

(c) Study the reaction scheme shown below.



(i) Give the structural formula of

A -----

B -----

C -----

(ii) Give the reagent(s) and reaction conditions for steps labelled v-z.

v -----

w -----

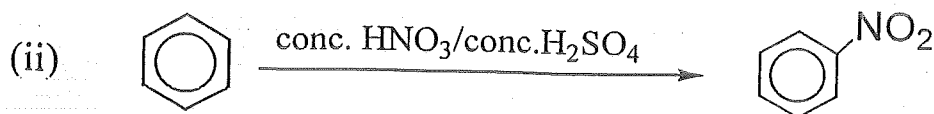
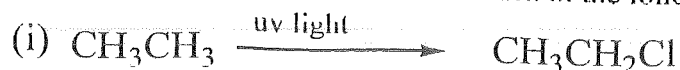
x -----

y -----

z -----

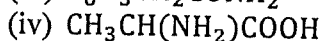
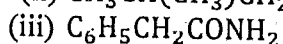
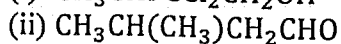
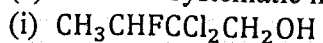
8 marks

- (d) Name the mechanism associated with each of the following reactions.

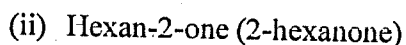
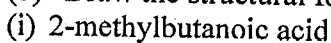


2 marks

6. (a) Give the systematic name of the following compounds



- (b) Draw the structural formula of each of the following compounds.

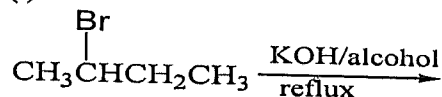


4 marks

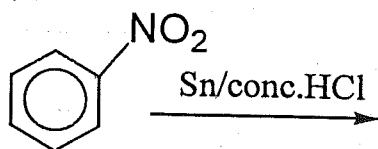


- (c) Give the products of following conversions.

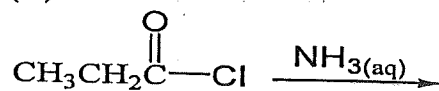
(i)



(ii)



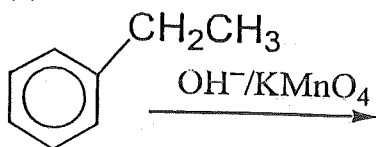
(iii)



(iv)



(v)



- (d) Suggest a chemical test to distinguish between the following pairs of compounds.



(i) -----

(ii) $\text{CH}_3\text{C} \equiv \text{CCH}_3$ and $\text{CH}_3\text{CH}_2\text{C} \equiv \text{CH}$ -----

6 marks

(e) Which compound is more basic: CH_3NH_2 or $\text{C}_6\text{H}_5\text{NH}_2$? -----

Explain -----

2 marks

SET 9: SECTION B (CGCEB 2017)

Organic Chemistry

5 (a) This question concerns the following organic compounds

A: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

B: $\text{CH}_3\text{CH}_2\text{CH}_2\text{OCH}_3$

C: $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$

D: $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCl}$

From the above set, select

i) Two compounds that are derivatives of carboxylic acids

ii) A compound obtained by the reaction of butanoic acid with PCl_5

iii) A compound that will give an acid and an alcohol on acid hydrolysis

(5 marks)

(b) (i) To what class of organic compounds does D belong?

(ii) Give the structural formula or name of the main organic product formed when compound D reacts with

A: Benzene in the presence of

AlCl_3 -----

A: LiAlH_4 /dry ether-----

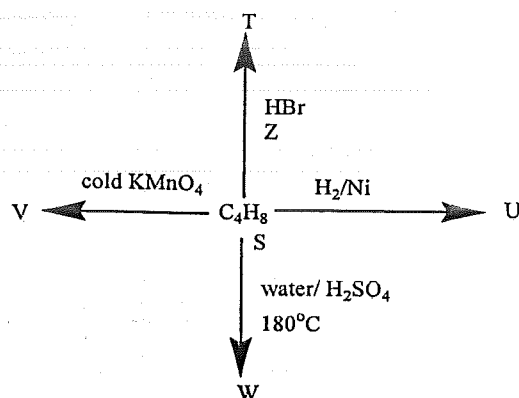
(3 marks)

(c) (i) A and B are isomers; state the type of isomerism involved.

(ii) Describe a simple chemical test to distinguish between compounds A and B

(3 marks)

(d) study the reaction scheme below for the reactions of but-1-ene (1-butene) and answer the questions that follow



(i) Give the structural formulae and names of the compounds T to W

Compound	Structure	Name
T		
U		
V		
W		

(ii) Name the organic reaction represented by z and outline the mechanism

(iii) Would you expect the boiling point of compound V to be higher than that of compound W?

Explain

(9 marks)

6. (a) An organic compound, X, contains 66.7% carbon, 11.1% hydrogen and 22.2% oxygen. The mass spectrum of X shows a molecular ion at $m/e=72$

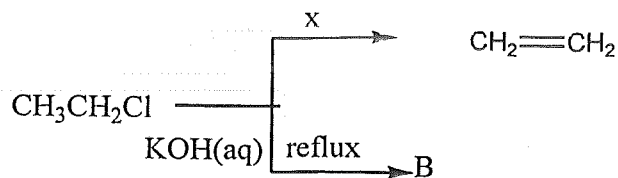
(i) Determine the empirical formula of X.

(ii) Determine the molecular formula of X

(iii) Give the structures of three isomers of X

(6 marks)

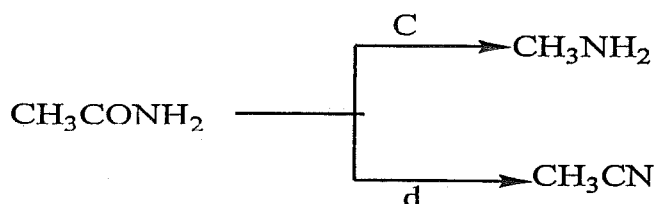
(b) Give the product formed or reagent and reaction conditions where necessary



(2 marks)

X: _____

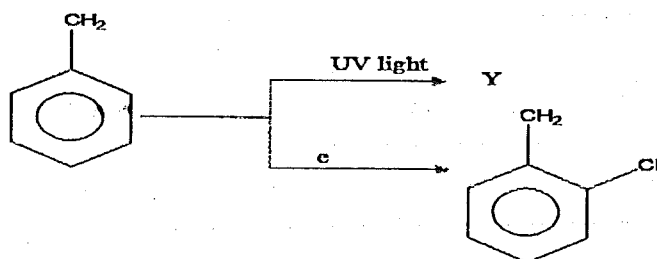
B: _____



(ii)

c: _____

d: _____

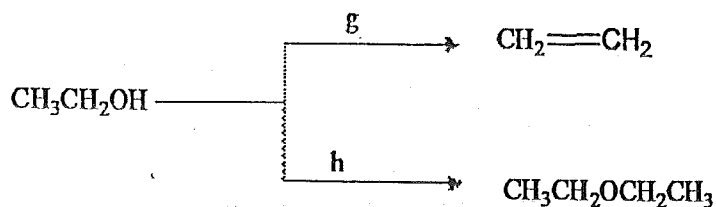


(iii)

Y: _____

e: _____

(6 marks)



(c) give the structural formula and the name of a compound that falls under each of the following classes of compounds

(i) A primary aliphatic amine _____

(ii) A primary aromatic amine _____

(iii) An aromatic diazonium salt _____

(iv) An amino acid. _____

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(4 marks)

(d) Write an equation to show how the compound to c(iv) above could be prepared.

You must indicate the reagents and reaction conditions must be stated-----

(2 marks)

SET 10: SECTION B (CGCEB 2018)

Organic Chemistry

5.(a) (i) Explain why carbon catenates extensively whereas silicon does not. -----

(ii) Give the type of hybridization of carbon and the shape of the molecule in the following compounds:

A: Ethene ----- shape -----

B: Ethyne:----- Shape-----

3 mks

(b) Compound A, $\text{CH}_3\text{CH}_2\text{CH}(\text{NH}_2)\text{COOH}$ is an organic nitrogen compound.

(i) Describe how the presence of nitrogen could be identified in the compound A above. -----

(ii) Identify any one type of isomerism exhibited by compound A, and give the structures of the isomeric compounds. -----

6 mks.

(c)(i) Write equations that illustrate the following reactions of carbonyl compounds.

A: a nucleophilic addition reaction. -----

B: a condensation reaction. -----

(ii) How would you account for the fact that Aliphatic Aldehydes are more reactive than their ketone counterparts? -----

3 mks

(d) An organic compound X, has the structural formula below.



The compound undergoes combustion giving a highly luminous, sooty flame.

(i) What accounts for the sootiness in the flame? -----

(ii) Give the product formed when compound X reacts with:

A: Bromine in carbon tetrachloride. -----

B: Bromine water. -----

(iii) Compound X reacts with dilute HCl(aq) / $\text{NaNO}_2\text{(aq)}$ at temperatures below 5°C . Suggest a reason why the temperatures below 5°C are used. -----

(4 mks).

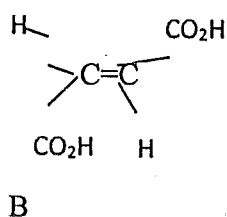
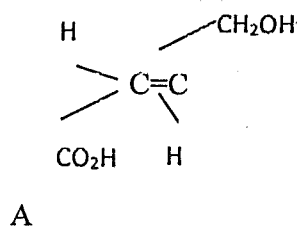
(e) (i) Write the structural formula of 2-chloromethylbenzene. -----

(ii) Show in two steps how you would prepare 2-nitromethylbenzene from benzene. -----

(iii) What name is given to the first step of the reaction in e(ii) above? -----

4 mks.

6. (a) Given compounds A and B below.



(i) How would compound B be obtained from compound A? -----

(ii) Compound B is a solid. How could a pure sample of this compound be obtained? -----

(iii) How could its purity be verified? -----
