BACHELOR OF SCIENCE (CBCS-2018 COURSE)
T. Y. B. Sc. Sem-VI :SUMMER- 2022
SUBJECT : CHEMISTRY : ORGANIC CHEMISTRY-II

Day : Thursday

Date : 7/7/2022

S-18472-2022
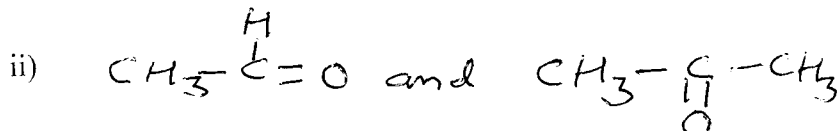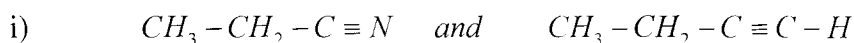
Time : 11:00 AM-02:00 PM

Max. Marks : 60

N.B.
1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Draw neat and labeled diagram wherever necessary.

Q.1 Attempt **ANY TWO** of the following : **(12)**

  a) What is Aldol condensation? Discuss its mechanism and applications.
  b) Explain the following :
      i) Bands in UV spectrum are very broad.
      ii) Phenol shows bathochromic shift in presence of alkali
  c) How will you distinguish the following pairs by IR spectroscopy?
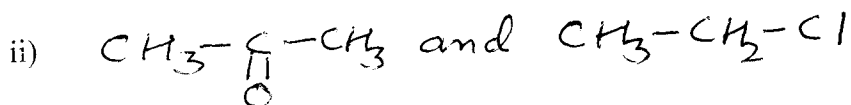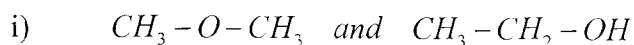
      i) $CH_3 - CH_2 - C \equiv N \quad and \quad CH_3 - CH_2 - C \equiv C - H$

      ii) $CH_3 - \overset{H}{\underset{}{C}} = O \quad and \quad CH_3 - \overset{}{\underset{O}{C}} - CH_3$

Q.2 Attempt **ANY TWO** of the following : **(12)**

  a) What is Wittig reaction? Discuss its mechanism and applications.
  b) Explain the following :
      i) Only one signal appears in the NMR spectrum of acetone, however propanal shows three peaks in its NMR spectrum.
      ii) TMS is used as an internal reference standard in NMR Spectroscopy.
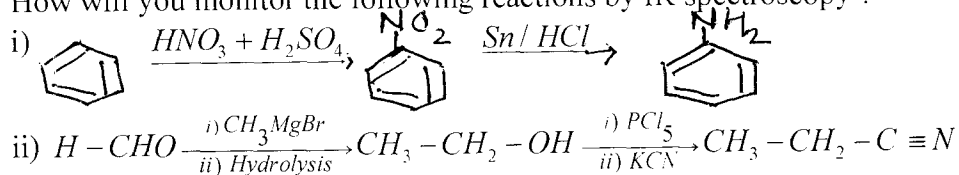 **c)** Write a note on : Applications of UV spectroscopy.

Q.3 Attempt **ANY TWO** of the following : **(12)**

  a) What are carbanions? Discuss their generation and stability.
  b) How will you distinguish the following pairs by NMR spectroscopy?

      i) $CH_3 - O - CH_3 \quad and \quad CH_3 - CH_2 - OH$

      ii) $CH_3 - \overset{}{\underset{O}{C}} - CH_3 \quad and \quad CH_3 - CH_2 - Cl$

PTO

c) How will you monitor the following reactions by IR spectroscopy ?

i) $\xrightarrow{HNO_3 + H_2SO_4}$, $\xrightarrow{Sn / HCl}$

ii) $H - CHO \xrightarrow[ii)\ Hydrolysis]{i)\ CH_3MgBr} CH_3 - CH_2 - OH \xrightarrow[ii)\ KCN]{i)\ PCl_5} CH_3 - CH_2 - C \equiv N$

Q.4 Assign the structure of **ANY THREE** of the following using spectral data: **(12)**

a)   *MF*   : C_8H_9Br

       PMR   :$2.0\,\delta$ (d, 3 H)

                $5.15\,\delta$ (q, IH)

                $7.55\ \delta$ (s, 5 H)

b)   *MF*   : $C_9H_{10}O$

       IR   : $1715\ cm^{-1}, 1590, 1550$ and $1460\ cm^{-1}$

       PMR   :2.09δ (s, 3 H)

                3.65δ (s, 2 H)

                $7.25\ \delta$ (s, 5 H)

c)   *MF*   : C_3H_8O

       IR   : $3300\ cm^{-1}$

       PMR   :0.9δ (t, 3 H)

                1.5δ (sextet, 2 H)

                $3.4\ \delta$ (t, 5 H)

                4.1δ (s, 1H)

d)   *MF*   : C_4H_8O

       UV   : $290nm$

       IR   : $1720\ cm^{-1}$

       PMR   : $1.05\,\delta$ (t, J = 6 Hz, 15 mm)

                $2.05\,\delta$ (s, 15 mm)

                $2.4\ \delta$ (q, J = 6 Hz, 10 mm)

Q.5 Attempt **ANY FOUR** of the following : **(12)**

a) What is spectroscopy? What are advantages of spectroscopic methods?

b) Indicate different sets of protons in the following compounds :
     i) $CH_3–CH_2–CH_3$
     ii) $CH_3–O–CH_2–O–CH_2–CH_3$
     iii) $CH_3–O–CH_2–CH_3$

c) Calculate fundamental modes of vibrations for :
     i) H_2O
     ii) CO_2
     iii) CS_2

d) Explain the terms :
     i)   Chromophores
     ii)   Auxochromes

e) Calculate λ max for the following compound.

i)   ii)
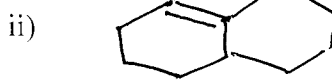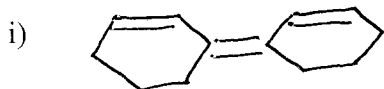
f) A compound $C_6H_{10}O$ shows negative iodoform test. It shows IR peaks at 2720 & $1700\ cm^{-1}$. It shows UV absorption at 240 nm. Suggest the structure.

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TABLE : 1

Characteristic Infrared Absorptions of Functional Groups

	Group	Frequency Range cm^{-1}	Intensity
A.	Alkyl		
	C–H (stretching)	2853 – 2962	(m-s)
	Isopropyl – CH (CH$_3$)$_2$	1380 – 1385	(s)
		and 1365 – 1370	(s)
		1385 – 1395	(m)
	tert-Butyl – C (CH$_3$)$_3$	and – 1365	(s)
B.	Alkenyl		
	C–H (stretching)	3010 – 3095	(m)
	C=C (stretching)	1620 – 1680	(v)
	R–CH=CH$_2$	985 – 1000	(s)
		and 905 – 920	(s)
	R$_2$C=CH$_2$ (out-of-plane	880 – 900	(s)
	cis-RCH=CHR C–H bendings)	675 – 730	(s)
	trans-RCH=CHR	960 – 965	(s)
C.	Alkynyl		
	≡ C–H (stretching)	3300	(s)
	C = C (stretching)	2100 – 2260	(v)
	C ≡ N (stretching)	2210 – 2260	(v)
D.	Aromatic		
	Ar–H (stretching)	3030	(v)
	Aromatic substitution type		
	(C–H out-of-plane bendings)		
	Monoasubstituted	690 – 710	(very s)
		and 730 – 770	(very s)
	o-Disubstituted	735 – 770	(s)
	m-Disubstituted	680 – 725	(s)
		and 750 – 810	(very s)
	p-Disubstituted	800 – 840	(very s)
E.	Alcohols, Phenols, Carboxylic Acids		
	OH (alcohols, phenols, dilute solns)	3590 – 3650	(sharp v)
	OH (alcohols, phenols, hydrogen bonded)	3200 – 3550	(broad, s)
	OH (carboxylic acids, hydrogen bonded)	2500 – 3000	(broad, v)
F.	Aldehydes, Ketones, Esters and Carboxylic Acids		
	C = O stretch	1630 – 1780	(s)
	Aldehydes	1690 – 1740	(s)
	Ketones	1680 – 1750	(s)
	Esters	1735 – 1750	(s)
	Carboxylic acids	1710 – 1780	(s)
	Amides	1630 – 1690	(s)
G.	Amics	3300 – 3500	(m)

TABLE : 2

Approximate Proton Chemical Shifts in N M R

Type of Proton	Chemical Shift, Delta, PPM (δ)
1° Alkyl, RCH_3	0.8 – 1.0
2° Alkyl, RCH_2R	1.2 – 1.4
3° Alkyl R_2CH	1.4 – 1.7 Ester $R-\overset{\overset{O}{\|\|}}{C}-O-CH_2-R$ 4 to 4.5
Alkylic, $R_2C = C - CH_3$ $\qquad\quad \|$ $\qquad\quad R$	1.6 – 1.9
Benzylic, $ArCH_3$	2.2 – 2.5
Alkyl chloride, RCH_2Cl	3.6 – 3.8
Alkyl bromide, RCH_2Br	3.4 – 3.6
Alkyl iodide, RCH_2I	3.1 – 3.3
Ether, $ROCH_2R$	3.3 – 3.9
Alcohol, $HOCH_2R$	3.3 – 4.0
Ketone, $RCCH_3$ $\qquad\quad \overset{\|\|}{O}$	2.1 – 2.6
Aldehyde, $R\overset{\overset{O}{\|\|}}{C}H$	9.5 – 9.6
Vinylic, $R_2C = CH_2$	4.6 – 5.0
Vinylic, $R_2C = CH$ $\qquad\qquad \|$ $\qquad\qquad R$	5.2 – 5.7
Aromatic, ArH	6.0 – 9.5
Acetylenic, $RC \equiv CH$	2.5 – 3.1
Alcohol hydroxyl, ROH	0.5 – 6.0[a]
Carboxylic, $RCOH$ $\qquad\qquad \overset{\|}{O}$	10 – 13[a]
Phenolic, ArOH	4.5 – 7.7[a]
Amino $R – NH_2$	1.0 – 5.0

[a] The chemical shifts of these groups vary in different solvents and with temperature and concentration.

TABLE : 3

U. V. Absorption rules for diene chromosphores		U.V. Absorption rules for Enone System	
1) Parent	215 nm	1) Parent	215 nm
2) Each extra conjugation	30 nm	2) Each extra conjugation	30 nm
3) Homoannular	39 nm	3) Homoannular	39 nm
4) Exocylic double bond	05 nm	4) Substituents	
5) Each alkyl (R) substituent directly attached to double bounded carbon	05 nm	a) Alkyl group at α	10 nm
		b) Alkyl group at β	12 nm
		c) Alkyl group at γ, δ	18 nm