SEAT No._____ No. of Printed Pages : 3+2

[36/A-8]
(Eng)

SARDAR PATEL UNIVERSITY

B.Sc. (Semester – VIth) Examination-2021.

Applied Chemistry

USO6CCHE24

Date:19/07/21 Time: 10:00 A.M. to 12:00 P.M.

Day: MONDAY Total Marks: 70

Note: 1. Figures to the right indicate full marks.

2. All questions are to be attempted.

Q. 1 Choose the correct option for the following : (MCQ) (10)

(1) How many NMR signals would you expect from n-propyl chloride?

(a) 5 (b) 4

(c) 3 (d) 6

(2) How many CMR signals would you expect from sec-Butyl bromide?

(a) 1 (b) 2

(c) 3 (d) 4

(3) How many isomers are possible for $C_2H_4Cl_2$?

(a) 1 (b) 3

(c) 2 (d) 4

(4) _____is used in the cough mixture.

(a) Acedapsone (b) Lidocaine

(c) Benadryl (d) Caprokol

(5) _____is used in the treatment of malaria.

(a) Chloroquine (b) Sulphafurazole

(c) Phenyl butazone (d) Phenobarbitone

(6) _____is used in the treatment of Gout.

(a) Methylene Blue (b) Hetrazane

(c) Dimenhydrinate (d) Chinchophen

(7) The electron transfer agent cytochrome contains_____metal.

(a) Ca (b) Fe

(c) Zn (d) Cu

(8) Which metal is responsible for structural stability of DNA and RNA?

(a) Magnesium (b) Calcium

(c) Zinc (d) Iron

(9) Very high consumption of electric power is serious disadvantage of____process for the production of nitric acid.

(a) Birkland and Eyde (b) Oswald's

(c) From Nitre (d) Electrolytic

(10) Valuable by-product obtain in_____ process during production of Sodium hydroxide.

(a) Causticizing (b) Lowing's

(c) Electrolytic (d) None of them

[P.T.O]

Q. 2 Fill in the blanks: (08)

(1) _____state has higher energy ? (α- spin / β – spin)

(2) The scale of δ ppm in CMR is _____. (0 - 50 / 0 – beyond 200)

(3) Lidocaine drug is used in the _____ surgery. (Dental / leprosy)

(4) Rifampin drug is a class of _____ drug. (Analgesic /Antitubercular)

(5) Urease metalloenzymes contains_____metal. (Zn / Ni)

(6) _____metal is important for transfer of oxygen in blood. (Pb / Fe)

(7) In_____cell mercury acts as an intermediate electrode.
(Castner-Kellner / Kellner-Solvay)

(8) Hydroxide of which of the following ____metal is soluble in excess of NaOH. (Zn / Fe)

Q. 3 Answer the following : (Any TEN) (20)

(1) Predict the number of signals in PMR spectroscopy of the following:
(a) 1,1-Dimethyl cyclopropane
(b) Cis -1,2-Dimethyl cyclopropane

(2) Why TMS is used as a reference standard in NMR spectroscopy ?

(3) Give the various aspects of NMR spectroscopy.

(4) Write the structure and use of the following drugs:
(a) Avil
(b) Aspirin

(5) Discuss the mode of action of antipyretic drugs.

(6) Write the synthesis of drug which is used in the treatment of cholera.

(7) What role does the zinc ion play in the action of carboxypeptidase ?

(8) Draw the structure of porphine.

(9) Write the name of four transition metals and two non transition metals that play important roles in biological processes.

(10) Explain causticizing process for manufacture of sodiumhydroxide.

(11) How metallic salts are affected by sodium hydroxide ?

(12) Write the laboratory method for the preparation of HNO_3.

Q. 4 Answer the following : (Attempt any 4 out of 8) (32)

(1) Acetylene protons are more shielded than ethylenic protons. Explain. Also draw the structure and give NMR signals for the following compounds
(a) 1,2-Dichloro propane
(b) P-Xylene
(c) Cumene

(2) Discuss in detail phenomenon of the splitting of NMR signals.

(3) Define "Drugs". What are the requirement of an ideal drugs ? Also discuss the classification of drugs.

(4) Write the synthesis and uses for the following drugs.
(a) Novalgin
(b) Dimenhydrinate

(5) State the main components of cobalamin. How do B_{12}, $B_{12}r$ and $B_{12}s$ differ ?

(6) What role does the magnesium ion play in the functioning of chlorophyll ?

(7) Describe lead chamber process in detail for manufacture of sulphuric acid.

(8) List different methods used for manufacture of nitric acid and discuss Oswald's process in detail.

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SPECTROSCOPIC DATA TABLES

N. M. R. Chemical Shifts

Type of proton		Chemical shift δ ppm	Type of Proton		Chemical shift δ ppm
Primary	RCH_3	0.9	Alcohols	HC–OH	3.4–4
Sec.	R_2CH_2	1.3	Ethers	HC–OR	3.3–4
Tert.	R_3CH	1.5	Esters	RCOO–CH	3.7–4.1
Vinylic	C=C–H	4.6–5.9	Esters	HC–COOR	2–2.2
Acetylenic C	C≡C–H	2–3	Acid(	HC–COOH	2–2.6
Aromatic	Ar–H	6–8.5	Carbonyl	HC–C=O	2–2.7
Benzylic	Ar–C–H	2.2–3	Aldehydic	RCHO	9–10
Allylic	C=C–CH_3	1.7	Hydroxylic	R–OH	1–5.5
Chloride	HC–Cl	3–4	Phenolic	Ar–OH	4–12
Bromides	HC–Br	2.5–4	Enolic	C=C–OH	15–17
Iodides	HC–I	2–4	Carboxylic	R–COOH	10.5–12
			Amino	$R-NH_2$	1–5

CH_3–Cl	δ 3.0
R–CH_2–Cl	δ 3.4
R_2CH–Cl	δ 4.0

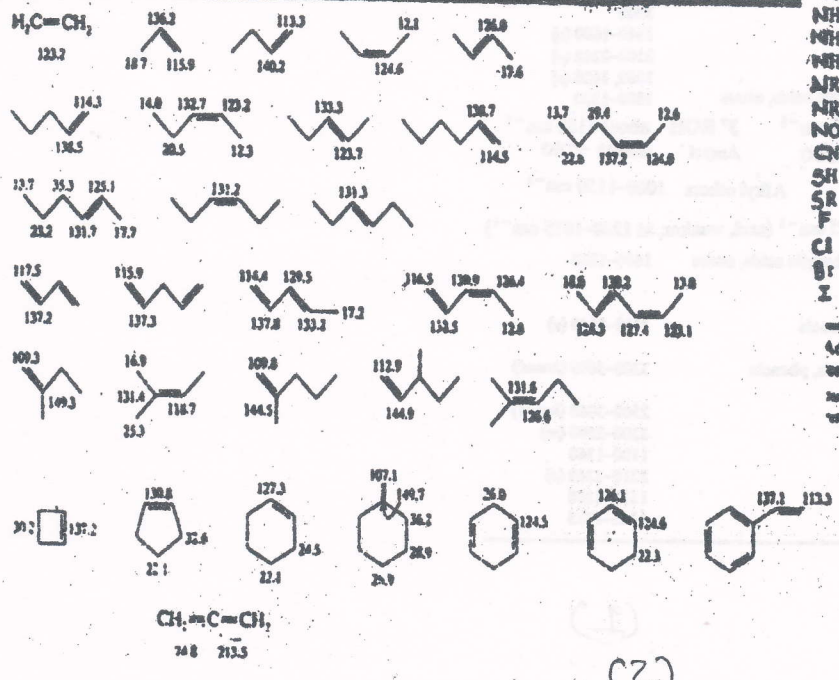
CH_3–C–Cl	δ 1.5
R–CH_2–C–Cl	δ 1.7
R_2CH–C–Cl	δ 1.6

Characteristic Infrared Absorption Frequencies[a] I.R

Bond	Compound type	Frequency range, cm^{-1}
C–H	Alkanes	2850–2960
		1350–1470
	tert-Butyl: unsymmetrical doublet:	1370 (*s*) 1395 (*m*)
	isopropyl "split"	1370 and 1385
	Methyl and methylene groups	1430–1470
	confirmed by a band	1170
C–H	Alkenes	3020–3080 (*m*)
		675–1000
	RCH=CH_2	910–920 cm^{-1}
		990–1000
	cis-RCH=CHR	675–730 (*variable*)
	$R_2C=CH_2$	880–900
	trans-RCH=CHR	965–975
C–H	Aromatic rings	3000–3100 (*m*)
		675–870
	monosubstituted	690–710 cm^{-1}
		730–770
	m-disubstituted	690–710
		750–810
	o-disubstituted	735–770
	p-disubstituted	810–840
C–H	Alkynes	3300
C=C	Alkenes	1640–1680 (*v*)
C≡C	Alkynes	2100–2260 (*v*)
C=C	Aromatic rings	1500, 1600 (*v*)
C–O	Alcohols, ethers, carboxylic acids, esters	1080–1300
	1° ROH about 1050 cm^{-1}	3° ROH about 1150 cm^{-1}
	2° ROH about 1100	ArOH about 1230
	Alkyl ethers	1060–1150 cm^{-1}
	Aryl and vinyl ethers	1200–1275 cm^{-1} (and, weaker, at 1200–1075 cm^{-1})
C=O	Aldehydes, ketones, carboxylic acids, esters	1690–1760
O–H	Monomeric alcohols, phenols	3610–3640 (*v*)
	Hydrogen-bonded alcohols, phenols	3200–3600 (*broad*)
	Carboxylic acids	2500–3000 (*broad*)
N–H	Amines	3300–3500 (*m*)
C–N	Amines	1180–1360
C≡N	Nitriles	2210–2260 (*v*)
$-NO_2$	Nitro compounds	1515–1560
		1345–1385

Substituent	C-1 (Attachment)	C-2	C-3	C-4	C of Substituent (ppm from TMS)
H	0.0	0.0	0.0	0.0	
CH_3	+9.3	+0.7	−0.1	−2.9	21.3
CH_2CH_3	+15.6	−0.5	0.0	−2.6	28.2 (CH_2), 15.8 (CH_3)
$CH(CH_3)_2$	+20.1	−2.0	0.0	−2.5	34.4 (CH), 24.1 (CH_3)
$C(CH_3)_3$	+22.2	−3.4	−0.4	−3.1	34.5 (C), 31.4 (CH_3)
$CH=CH_2$	+9.1	−2.4	+0.2	−0.5	137.1 (CH), 113.3 (CH_2)
$C\equiv CH$	−5.8	+6.9	+0.1	+0.4	84.0 (C), 77.8 (CH)
C_6H_5	+12.1	−1.6	−0.1	−1.6	
CH_2OH	+13.3	−0.8	−0.6	−0.6	64.5
CH_2OCCH_3 (O)	+7.7	−0.0	−0.0	−0.0	20.7 (CH_3), 66.1 (CH_2), 170.5 (C=O)
OH	+26.6	−12.7	+1.6	−7.3	
OCH_3	+31.4	−14.4	+1.0	−7.7	54.1
OC_6H_5 (O)	+29.0	−9.4	+1.6	−5.3	
$OCCH_3$ (O)	+22.4	−7.1	−0.4	−3.2	21.9 (CH_3), 169.7 (C=O)
CH (O)	+8.2	+1.2	+0.6	+5.8	192.0
CCH_3 (O)	+7.8	−0.4	−0.4	+2.8	34.6 (CH_3), 195.7 (C=O)
CC_2H_5 (O)	+9.1	+1.5	−0.2	+3.8	196.4 (C=O)
CCF_3 (O)	−5.6	+1.8	+0.7	+6.7	
COH (O)	+2.9	+1.3	+0.4	+4.3	168.0
$COCH_3$ (O)	+2.0	+1.2	−0.1	+4.8	51.0 (CH_3), 166.0 (C=O) 168.5
CCl (O)	+4.6	+2.9	+0.6	+7.0	
CNH_2 (O)	+5.0	−1.2	0.0	+3.4	
$C\equiv N$	−16.0	+3.6	+0.6	+4.3	119.5
NH_2	+19.2	−12.4	+1.3	−9.5	
$N(CH_3)_2$ (O)	+22.4	−15.7	+0.8	−11.8	40.3
$NHCCH_3$ (O)	+11.1	−9.9	+0.2	−5.6	
NO_2	+19.6	−5.3	+0.9	+6.0	
$N=C=O$	+5.7	−3.6	+1.2	−2.8	129.5
F	+35.1	−14.3	+0.9	−4.5	
Cl	+6.4	+0.2	+1.0	−2.0	
Br	−5.4	+3.4	+2.2	−1.0	
I	−32.2	+9.9	+2.6	−7.3	
CF_3	+2.6	−3.1	+0.4	+3.6	
SH	+2.3	+0.6	+0.2	−2.7	
SCH_3	+10.2	−1.8	+0.6	−3.6	15.9
SO_2NH_2	+15.3	−2.9	+0.4	+3.3	
$Si(CH_3)_3$	+15.4	+4.4	−1.1	−1.1	

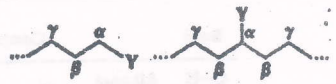
Alkene and Cycloalkene Chemical Shifts (ppm from TMS)



The ^{13}C Shift Parameters in Some Linear and Branched Hydrocarbons

^{13}C Atoms	Shift (ppm) (A)
α	+9.1
β	+9.4
γ	−2.5
δ	+0.3
ε	+0.1
1° (3°)ᵃ	−1.1
1° (4°)ᵃ	−3.4
2° (3°)ᵃ	−2.5
2° (4°)	−7.2
3° (2°)	−3.7
3° (3°)	−9.5
4° (1°)	−1.5
4° (2°)	−8.4

Incremental Substituent Effects (ppm) on Replacement of H by Y in Alkanes. Y is Terminal or Internal[a] (+ left, − right)



	α		β		γ
	Terminal	Internal	Terminal	Internal	
CH_3	+ 9	+ 6	+10	+ 8	−2
$CH=CH_2$	+20		+ 6		−0.5
$C\equiv CH$	+ 4.5		+ 5.5		−3.5
COOH	+21	+16	+ 3	+ 2	−2
COO^-	+25	+20	+ 5	+ 3	−2
COOR	+20	+17	+ 3	+ 2	−2
COCl	+33	+28		+ 2	
$CONH_2$	+22		+ 2.5		−0.5
COR	+30	+24	+ 1	+ 1	−2
CHO	+31		0		−2
Phenyl	+23	+17	+ 9	+ 7	−2
OH	+48	+41	+10	+ 8	−5
OR	+58	+51	+ 8	+ 5	−4
OCOR	+51	+45	+ 6	+ 5	−3
NH_2	+29	+24	+11	+10	−5
NH_3^+	+26	+24	+ 8	+ 6	−5
NHR	+37	+31	+ 8	+ 6	−4
NR_2	+42		+ 6		−3
NR_3^+	+31		+ 5		−7
NO_2	+63	+57	+ 4	+ 4	
CN	+ 4	+ 1	+ 3	+ 3	−3
SH	+11	+11	+12	+11	−4
SR	+20		+ 7		−3
F	+68	+63	+ 9	+ 6	−4
Cl	+31	+32	+11	+10	−4
Br	+20	+25	+11	+10	−3
Σ	− 6	+ 4	+11	+12	−1

[a] Add these increments to the shift values of the appropriate carbon atom in Table 5.2 or to the shift value calculated from Table 5.1.

Source: Wehrli, F.W., Marchand, A.P., and Wehrli, S. (1983). *Interpretation of Carbon-13 NMR Spectra*, 2nd ed. London: Heyden.