Total No. of Questions : 6]

SEAT No. : ____

P1905

[Total No. of Pages : 3

[5323]-401
M.Sc. - II
PHYSICAL CHEMISTRY
CHP - 410 : Molecular Structure and Spectroscopy
(2013 Pattern) (Semester - IV) (New)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Logarithmic table / calculator is allowed.***

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Distinguish between δ and τ Chemical Shift Scales.

b) Explain the terms with respect to nmr spectroscopy.

i) Deshielding and

ii) Coupling constant.

c) What is kramers degeneracy?

d) Write the applications of nqr.

e) Why esr spectra are always recorded in the derivative form? Explain.

Q2) Attempt any two of the following: **[10]**

a) Explain the instrumentation involved in high resolution nmr spectroscopy.

b) What is g-value? Explain the factors affecting it.

c) What is the need of reference for recording high resolution nmr? Explain the advantages of TMS.

d) Explain the concept of electric field gradient and quadrupole coupling constant.

Q3) Solve any one of the following: **[5]**

a) Differentiate among the following compounds from ^{19}F spectra at high field.

$CH_3-CH_2F,\ CH_2F-CH_2F,\ CH_3-CF_3$

b) Calculate the precessional frequency of a proton in a field of 1.8T. The *g* factor for proton is 5.585.

SECTION - II

Q4) Attempt the following: **[10]**

a) What is the principle of X-ray diffraction?

b) Explain how the Wierl equation is used to deduce molecular geometry.

c) Write Van-Vlecks formula and explain the terms therein.

d) Enlist the applications of neutron diffraction technique.

e) State the phase, problems in XRD.

Q5) Attempt any two of the following: **[10]**

a) Give a brief account of main XRD methods used in the elucidation of the crystal structure of NaCl and KCl. What are limitations of Bragg's method?

b) Distinguish between ferrimagnetism and antiferromagnetism with suitable examples.

c) Describe the instrumentation of neutron diffraction technique with a suitable diagram.

d) Explain the cause of electron diffraction. How is it experimentally studied?

Q6) Solve any one of the following: **[5]**

a) The mass and density of copper atom are 63.5 and 8.94 gcm^{-3} respectively. It has FCC structure. Calculate the atomic radius of copper atom.

b) Calculate molar susceptibility of phenanthroline ($C_{12} H_8 N_2$) and pyridine ($C_5 H_5 N$) from following data.

* pascal constant (χ_A) in cgs unit

C = -6.0×10^{-6}, H = -2.93×10^{-6}, ring N = -4.61×10^{-6}

* Constitutive corrections (λ)

C in one ring = -0.24×10^{-6}

C shared by two rings = -3.07×10^{-6}

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