

Total No. of Questions : 6]

SEAT No. :

P1905**[5323]-401**

[Total No. of Pages : 3

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

P.T.O.

SECTION - I

Q1) Attempt the following: [10]

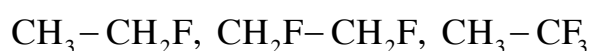
- a) Distinguish between δ and τ Chemical Shift Scales.
- b) Explain the terms with respect to nmr spectroscopy.
 - i) Deshielding and
 - ii) Coupling constant.
- c) What is kramers degeneracy?
- d) Write the applications of nqr.
- e) Why esr spectra are always recorded in the derivative form? Explain.

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.



- 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]

- What is the principle of X-ray diffraction?
- Explain how the Wierl equation is used to deduce molecular geometry.
- Write Van-Vlecks formula and explain the terms therein.
- Enlist the applications of neutron diffraction technique.
- State the phase, problems in XRD.

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

- 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?
- Distinguish between ferrimagnetism and antiferromagnetism with suitable examples.
- Describe the instrumentation of neutron diffraction technique with a suitable diagram.
- Explain the cause of electron diffraction. How is it experimentally studied?

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

- 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.
- Calculate molar susceptibility of phenanthroline ($\text{C}_{12}\text{H}_8\text{N}_2$) and pyridine ($\text{C}_5\text{H}_5\text{N}$) from following data.

* pascal constant (χ_A) in cgs unit

$$\text{C} = -6.0 \times 10^{-6}, \text{H} = -2.93 \times 10^{-6}, \text{ring N} = -4.61 \times 10^{-6}$$

* Constitutive corrections (λ)

$$\text{C in one ring} = -0.24 \times 10^{-6}$$

$$\text{C shared by two rings} = -3.07 \times 10^{-6}$$

