Total No. of Questions :6]

P1881

SEAT No. :

[Total No. of Pages : 3

[5223]-401

M.Sc. -II

PHYSICAL CHEMISTRY

CHP - 410 : Molecular Structure & Spectroscopy

(New) (2013 Pattern) (Semester - IV)

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 tables/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)   Discuss factors influencing coupling constant.

b)   Explain the theory of spin-spin interaction for an ABC type molecule.

c)   Explain principle of esr.

d)   State and explain Mc connell relation. Explain the terms there in.

e)   What are quadrupole nuclei and quadrupole moments in nqr spectroscopy?

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

a)   Write a note on ^{13}C nmr spectroscopy.

b)   State the characteristics of high resolution nmr instrumentation.

c)   Describe the working of esr spectrometer using block diagram.

d)   Explain applications of nqr. Give examples.

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

a)   Calculate the frequency separation of nuclear spin states in ^{13}C nucleus with magnetic field.

14.4 T. The magnetogyric ratio is 6.73×10^7 $T^{-1}s^{-1}$. [$I = \dfrac{1}{2}$ for ^{13}C]

b)   Compare the number of lines in esr of radicals

$\cdot XH_2$ and $\cdot XD_2$ $\left[\dot{X} \text{ spin state is } \dfrac{5}{2} \right]$.

SECTION - II

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

a)   Describe the theory of paramagnetism.

b) State limitations of Bragg's method.

c) Explain principle of XRD.

d) What causes electron diffraction patterns to occur?

e) Differentiate between neutron and electron diffraction.

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

a) Derive the Langevin equation for magnetic suceptibility.

b) Compare Guoy and Faraday techniques.

c) Discuss the applications of XRD in structural analysis.

d) Describe electron diffraction analysis technique giving a diagram and indicate how the wierl equation is used to deduce molecular geometry.

Q6) Solve any one of the following [5]

a) Calculate the volume and mass paramagnetic suceptibilities of a sample of a complex salt with 3 unpaired electrons, at 25°C.

[Density = 3.24 g cm^{-3}, molar mass = 200g mol^{-1}]

b) A beam of X-rays having 154.1 pm wavelength is reflected at 22.2° by a silver crystal. Deduce the interplanar spacing in the silver crystal.(n=1).

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