M. SC. (ANALYTICAL CHEMISTRY) / M. SC. (ORGANIC CHEMISTRY) /M. SC. (INORGANIC CHEMISTRY) SEM-II (CHOICE BASED CREDIT & GRADE SYSTEM) : SUMMER - 2018

SUBJECT: PHYSICAL CHEMISTRY-II

Day : **Wednesday**
Date : **11/04/2018**

Time : **03.00 PM TO 06.00 PM**
Max. Marks : 60.

S-2018-0870

N.B.:

1) All questions are **COMPULSORY.**
2) Both the sections should be written in **SEPARATE** answer books.
3) Figures to the **RIGHT** indicate full marks.
4) Draw neat labeled diagrams **WHEREVER** necessary.
5) Use of logarithmic tables/ calculator is **ALLOWED.**
6) Graph papers will be provided.

Physico-Chemical Constants

1.	Avogadro Number	$N = 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	$k = 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
		$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	$h = 6.626 \times 10^{-27}$ erg s
		$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	$e = 4.803 \times 10^{-10}$ esu
		$= 1.602 \times 10^{-19}$ C
5.	1 eV	$= 23.06$ k cal mol^{-1}
		$= 1.602 \times 10^{-12}$ erg
		$= 8065.5$ cm^{-1}
6.	Gas Constant	$R = 8.314 \times 10^{7}$ 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	$c = 2.997 \times 10^{10}$ cm s^{-1}
		$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal	$= 4.184 \times 10^{7}$ erg
		$= 4.184$ J
10.	1 amu	$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	$\beta_e = 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg
14.	Mass of proton	1.672×10^{-27} kg

P.T.O.

SECTION-I

Q.1 Answer any **THREE** of the following: **(15)**

a) With suitable examples, describe how Raman and Infra-Red spectroscopy together help in structural determination of the molecules?

b) Describe rotational fine structure in Raman spectroscopy.

c) Explain the meaning of the Anharmonic Oscillator. How do you find out the force constant for a typical molecule using fundamental absorption, first overtone and second overtone?

d) How do you find dissociation energy value D_0'' by using electronic spectroscopy of the molecules?

e) Discuss briefly the applications of Mossbauer spectroscopy.

Q.2 **A)** Attempt any **TWO** of the following: **(10)**

a) Briefly give the introduction to the Electron spin resonance spectroscopy. Comment upon the 'g' factor involved in E.S.R.

b) Discuss various applications of Microwave spectroscopy.

c) Describe with suitable example the fundamental vibrations and the symmetry associated with these vibrations.

B) Solve any **ONE** of the following: **(05)**

a) The band origin of transition is C_2 is found at 19376 cm^{-1}. The rotational fine structure shows that rotational constants in excited state and ground state are, respectively, $B' = 1.7525\ cm^{-1}$ and $B'' = 1.6328\ cm^{-1}$. Estimate the position of band head.

b) In a certain spectroscopic transition, the wavelength of the radiation absorbed is 18 μm. Find out the energy change during this transition in joules per mole.

SECTION-II

Q.5 Attempt any **THREE** of the following: **(15)**

a) Discuss the various units for measuring radiation absorption.

b) What is hydrated electron? Give methods obtaining it and explain the characteristics of physical and chemical properties of it.

c) Write note on scintillation counter.

d) Explain the method to determine the surface area of powder or precipitate.

e) What is tracer? Discuss the radiochemical principles in the use of tracers.

Q.4 **A)** Attempt any **TWO** of the following: **(10)**

a) Describe the method of determination of solubility of sparingly soluble salt using radioactive tracer.

b) Discuss the radiation tracks, spure and del-rays.

c) Which are the principle modes of interaction of gamma radiation with matter? Discuss the Compton scattering.

B) Solve any **ONE** of the following: **(05)**

a) Calculate the $\left(\overline{Z/A}\right)$ values for (i) Formic acid (ii) Benzoic acid.

b) A e^{μ} = 0.211 barn per electron and density of methanol is 0.745 gm cm^{-3}. Find out the linear, mass and atomic absorption coefficient of methanol.

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