M. SC. (Analytical Chemistry) / M. SC. (Organic Chemistry) / M. SC. (Inorganic Chemistry) Sem-II (CBCS – 2018 Course) : SUMMER - 2019

SUBJECT : PHYSICAL CHEMISTRY – II

Day : Thursday
Date : 25/04/2019

S-2019-1165

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

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of log table/scientific calculator is allowed.
4) Answer to both the sections should be written in the **SEPARATE** answer book.

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.	1eV	$= 23.06$ 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 Attempt any **THREE** of the following: **(15)**

a) Explain Quadrupole effect of Mossbauer spectroscopy.

b) What is "Predissociation"? Explain it by using suitable diagram.

c) Give the meaning of "Anharmonic Oscillator". Derive an expression

$$E_v = \left(v+\frac{1}{2}\right)\bar{\omega}_e - \left(v+\frac{1}{2}\right)^2 \bar{\omega}_e \chi_e \ cm^{-1}, \ v = 0,1,2....$$ Explain each term involved in it.

d) Explain vibrational –Raman spectra for H_2O molecule.

e) Derive an expression for rotational constant of rigid diatomic molecule.

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

a) Explain the Born-Oppenheimer Approximation with respect to Electronic spectroscopy of molecules.

b) What is the principle of electron spin resonance spectroscopy? Explain the g-factor involved in it.

c) State and explain the rule of mutual exclusion and its converse.

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

a) The pure rotational spectrum of gaseous HCl consists of a series of equally spaced lines separated by 20.80 cm^{-1}. Calculate the internuclear distance of the molecule. The atomic masses are $^{1}H = 1.673 \times 10^{-27}$ kg

$^{35}Cl = 58.06 \times 10^{-27}$ kg

b) For $^{23}Na\ ^{19}F$, $\bar{\omega}_e = 536.10\,cm^{-1}$ and $\chi_e \bar{\omega}_e = 3.4 cm^{-1}$.

Calculate the frequencies of first and second vibrational overtone transitions.

SECTION – II

Q.3 Attempt any **THREE** of the following: **(15)**

a) Write a note on "Neutron Activation Analysis".

b) What are scavengers? How were they used in the radiolysis of water?

c) Discuss the linear, mass, atomic and electronic absorption coefficients.

d) List the ionic, radical and molecular products of radiolysis of water. How are the products formed?

e) Describe with the suitable example how the surface area of a precipitate is determined using radiotracer technique.

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

a) How is the radioisotope used to find the reaction mechanism of oxidation of fumaric aid by KM_nO_4.

b) Explain Samuel-Magee and Lea-Gray-Platzmann model for radiolysis.

c) Explain Fricke dosimetry in detail.

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

a) Find the biologically effective does in Sieverts and in rem for a radiation dose of 0.6 Gy due to

i) α – particle

ii) thermal neutrons

iii) γ-radiation

b) Calculate the $\overline{Z/A}$ values for **i)** cyclohexane **ii)** acetic acid.
(Atomic wt. : H = 1, C = 12, O = 16), (Atomic No.: H = 1, O = 8, C = 6)

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