Total No. of Questions :6]

SEAT No. : ____

P1384

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M.Sc. (Semester III)

PHYSICAL CHEMISTRY

CHP - 312 : Physico-Chemical Methods of analysis

(2013 Pattern) (New)

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

Instructions to the candidates:

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

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} $molecule^{-1}$
		$= 1.38 \times 10^{-23}$ JK^{-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 e V	$= 23.06$ k cal mol^{-1}
		$= 1.602 \times 10^{-12}$ erg
		$= 1.602 \times 10^{-19}$ J
		$= 8065.5$ cm^{-1}
6)	Gas constant	$R = 8.314 \times 10^{7}$ $ergk^{-1}$ mol^{-1}
		$= 8.314$ Jk^{-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)	1amu	$= 1.673 \times 10^{-27}$ 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

P.T.O

SECTIONS - I

Q1) Answer precisely the following . **[10]**

a) Explain the ways by which an excited ion relax in ESCA technique.

b) Draw a neat labelled diagram of an ESCA spectrometer.

c) What is meant by EXAFS? Give two applications of x-ray absorption.

d) Calculate the short - wavelength cut off the lamp when an accelerating potential in an x-ray tube is 15.5 kv.

e) Explain the term thermal analysis. enlist the various methods of thermal analysis.

Q2) Answer any two of the following. **[10]**

a) What is x-ray fluorescence? Draw a neat labelled diagram of wavelength-dispersive and energy -dispersive instrument used for fluorescence.

b) Explain spectral splitting and chemical shift observed in ESCA technique.

c) Discuss the applications of DSC technique.

d) Describe the cylindrical mirror analyzer used in ESCA spectrometer.

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

a) Gypsum showed mass loss of about 15 % of original sample mass due to complete dehydration at 170°C. Determine the number of water molecules present in gypsum.

(Given : Atomic weight of Ca = 40, s = 32, o = 16, H = 1)

b) Calculate the wavelength of x-ray photon in nanometer that was used to create inner - shell vacancy in fluorine.

Given : ϕ of the spectrometer = 4.71 eV, k.E. of electron = 799v and B.E. for f = 696 eV.

SECTION - II

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

a) Define singlet state, doublet state and triplet state .

b) State the characteristics of plasma.

c) State the principle of voltommetry .

d) Write the equation for limiting current an hydrodynamic voltammetry. Explain the terms in it.

e) What are the fundamental requirement to perform coulometric titrations?

Q5) Answer any two of the following **[10]**

a) Explain liquid - phase chemiluminescence titration with a typical example.

b) Draw a neat labelled diagram of a typical plasma and show different temperature zone in it.

c) Describe controlled - potential coulometry.

d) What is polarizable electrode? Describe different electrodes used in voltammetry.

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

a) An electro active species yielded wave with a limiting current 25.5 μA at the rotating disc electrode which was rotated at 20.0 r/s. What limiting current would be expected at 50 r/s?

b) Constant current coulometry was used to assay a solution containing Fe^{+2}. To ensure 100% current efficiency, the assay was performed in 0.1m Ce^{+3} acidic solution at the end point of tilration 30ml sample, a controlled current of 6.45 mA had flowed for 185 second. Calculate the concentration of Fe^{+2} in the sample.