Total No. of Questions : 6]

SEAT No. :

P1462

[Total No. of Pages : 3

[5223]-33
M.Sc. - II
PHYSICAL CHEMISTRY
CH-312 : Advanced Instrumental Methods of Analysis
(2008 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 80*

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 and calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico-Chemical Constants

1.	Avogadro Number	N	$= 6.022\times10^{23}$ 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
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ 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}
			$= 2.997\times10^{8}$ 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	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051\times10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11\times10^{-31}$ kg

P.T.O.

SECTION-I

Q1) Answer any three of the following: **[15]**

a) How are X-rays generated? Describe the construction and working of an X-ray tube with a neat labelled diagram.

b) What is gas ionization detector? Describe various regions observed in gas ionization detector.

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

d) Discuss the principle of NAA. What are its advantages and disadvantages?

e) Discuss in brief the applications of mass spectrometry.

Q2) Answer any three of the following. **[15]**

a) Discuss the choice of post irradiation assay in activation analysis technique.

b) Define soft ionization method. Describe any one method of soft ionization.

c) Draw and explain block diagram of the major components of an instrument used to measure photoluminescence.

d) Write a note on X-ray fluorescence.

e) Write a note on excitation function.

Q3) Solve any two of the following. **[10]**

a) The ionization energy of argon atom is 9.6×10^{-18} J. The argon gas is irradiated by X-ray photon in ionization chamber having wavelength of 1nm. How many ion-electron pairs will be formed by considering 40% efficiency of ionization.

b) 0.5g of steel sample containing vanadium was irradiated for seven minutes in a neutron flux of 10^7 $ncm^{-2}s^{-1}$. Activity at the end of irradiation was found to be 2460 dpm. Find the percentage of vanadium in steel.

[Given : $t_{½}$ of ^{52}V = 3.75 min, r = 99.75%, σ = 4.88b]

c) A magnet has a field strength of 0.19T. The radius of curvature of the ion path is 10.4cm. Determine the accelerating voltage required to direct a singly charged water molecule through an exit slit of the mass spectrometer.

SECTION-II

Q4) Answer any three of the following. **[15]**

a) What is the basic difference between DSC and DTA?

b) With a neat labelled diagram explain sample introduction in ICP spectrometer.

c) Discuss the applications of ESCA technique.

d) What is plasma? Explain briefly the principle underlying inductively coupled plasma atomic emission spetroscopy.

e) Define the term, 'quantum efficiency'(ϕ). Derive the relation,

$I_L = \phi\ I_0\ 2.303\ a.b.c$

Q5) Answer any three of the following. **[15]**

a) Give an account of general technique for performing a coulometric determination at controlled cathode potential?

b) Discuss current-voltage relationship in coulometric technique.

c) Enlist the properties of the ideal instrument for plasma emission spectroscopy.

d) Write a note on pulse voltammetry.

e) Discuss the applications of TGA technique.

Q6) Solve any two of the following. **[10]**

a) A thermogram of a magnesium compound showed a loss of 80mg from a total of 160mg used for analyte. Identify the compound as MgO, $MgCO_3$ or MgC_2O_4.

b) Nickel ore weighing 2.15g is dissolved in acid and the nickel is electrolysed using constant current of 1.8A for 10 minutes. Calculate the percentage of nickel ore. [At. wt. of Ni = 58.7]

c) Calculate geometrical cross-section for copper atom.

[Given : $R_0 = 1.4 \times 10^{-13}$ cm, Atomic wt. of Cu = 63]

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