

Vidya Prasarak Mandal's  
B. N. Bandodkar college of science, Thane-400 601.

Preliminary examination, Feb-2012.

T. Y. B. SC.

Chemistry-I

Day:

TIME: 3 hrs

Date: 0 -02-2012

MARKS: 100

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N.B.: 1) All questions are compulsory

2) Figures to the right indicate full marks.

3) Use of log tables/non-programmable calculator is allowed

Constants

|  |   |
|--|---|
| Avogadro's Number $N=6.023 \times 10^{23}$       | 1a.m.u. = $1.66 \times 10^{-27}$ kg = 931 MeV |
| Boltzmann Constant $k=1.38 \times 10^{-23}$ J/K  |   |
| Faraday Constant $F=96500$ Coulombs              | Pie ( $\pi$ ) = 3.142                         |
| Gas Constant $R=8.314$ J/mol/K                   |   |
| Planck Constant $h=6.625 \times 10^{-34}$ Js     | $2.303RT / F = 0.0592$ at 298 k               |
| Speed of light in vacuum $c=3.0 \times 10^8$ m/s |   |
|  |   |

Q1. Answer the following:

a What is meant by eutectic point ? Explain Pattinson's process for desilverisation of lead. 3

OR

a Explain the action of catalytic promoters & catalytic poisons. 3

b State & explain the rule of mutual exclusion. 3

OR

b Represent quinhydrone electrode conventionally. To which class this electrode belong ? Give electrode reaction ? 3

c Define -Q-value of a nuclear reaction. What is its significance ? How it is related to threshold energy ? 3

d Give three important advantages of hydrogen as universal energy medium. 3

e Explain the term Dipole moment. 2

- f Explain Dorn effect. 2
- g What is Compton effect ? 2

OR

- g How are chemical reactions classified on the basis of their rate constant & half time? 2
- h Explain the term (1)relative viscosity (2)intrinsic viscosity. 2

OR

- h What are the characteristics of the internal standard TMS used in NMR spectroscopy ? 2
- Q 2 a Benzoic acid associates in benzene to form a double molecule. 1.65 g of benzoic acid when dissolved in 100 g benzene raised the boiling point by 0.18 K. Calculate the Van't Hoff factor & the degree of association of Benzoic acid in benzene . 5

Give- $K_b$  for benzene =2.53K Kg/mol

Normal molar mass of Benzoic acid=122 g/mol

OR

- a The volume of Nitrogen gas required at S.T.P.to cover the sample of silica gel with unimolecular layer is  $129\text{cm}^3/\text{g}$ . Calculate the surface area per g of the gel if each nitrogen molecule occupies  $16.2 \times 10^{-20}\text{m}^2$ . 5
- Attempt any three of the following:.
- b Define Ebullisopic constant.Derive thermodynamically the relation between the elevation in boiling point of a solution & molality of the dissolved non-volatile solute. 5
- c Explain the three component system exhibiting formation of one pair of partially miscible liquids. 5
- d State BET equation & explain the terms involved in it. 5
- e What are the surfactants ? Discuss the application of surfactants in (1)Food industry (2)pesticide formulation. 5

Q 3

- a In the investigation of a diatomic molecule by Raman Spectroscopy a substance was exposed to radiation of wavelength  $4.5 \times 10^{-6}\text{m}$ . If the frequency difference between the first stoke line & the first Anti-stokes line is  $7.2 \times 10^4 /\text{m}$ ,calculate the frequencies of the two line. 5

OR

- a Calculate the mean activity coefficient of potassium chloride in a solution,which is 0.01 m in potassium chloride & 0.05 m in sodium sulphate. 5

The constant A in the Debye-Huckel limiting equation is 0.509 for water at 298 K.

Attempt any three from the following:

- b What is rotational vibrational spectra? Show that the frequencies of the fundamental & second overtone bands are approximately in the ratio 1:3. 5
- c Explain how solubility of a sparingly soluble salt can be determined experimentally using concentration cell principle. 3  
2
- d Explain the effect of isotopic substitution on the rotational energy levels & rotational spectrum of a diatomic molecule. 5
- e What is liquid junction potential? How does it arise? How is it eliminated? 5
- Q 4
- a The half life period of  $^{238}\text{U}$  is  $4.9 \times 10^9$  years. Calculate the number of atoms of U in equilibrium with 1.0 g of  $^{226}\text{Ra}$ . The decay constant of  $^{226}\text{Ra}$  is  $4.3 \times 10^{-4}$  per year. 5
- OR
- a  $A = 5x^3$ ,  $B = d/dx$ ,  $f(x) = \cos x$  5
- Find whether A & B are commutative.
- Attempt any three of the following
- b Explain how radioisotopes are used as tracers in chemical analysis. 5
- c Give an account of Lindemann's unimolecular theory of reaction rates. 5
- d State Schrodinger's time independent wave equation & explain the terms involved in it. Give two characteristics of wave function. 5
- e What is Scintillation counter? Describe its working with particular reference to photomultiplier tube. 5
- Q 5
- a (1) In a particular sample of a polymer, 100 molecules have molecular weight  $10^3$  each & 300 molecules have molecular weight  $10^4$  each. Calculate the number-average molecular weight of the polymer. 5
- (2) Sodium chloride crystallizes in the fcc form with an edge length  $5.63 \text{ \AA}$ . The density of sodium chloride is  $2.17 \times 10^3 \text{ Kg.m}^{-3}$  & its molecular weight is 58.5. Calculate Avogadro's number.
- OR
- a During the electrolysis of water, hydrogen & oxygen are liberated with standard free energy change of  $-80.5 \text{ KJ}$  at  $298 \text{ K}$ . Calculate the 5

decomposition potential of the process

Given- $pK_w = 14$ .

Attempt any three of the following

- b Give comparative account of Schottky & Frenkel defects. 5
- c What is photovoltaic effect ? Explain the working of silicon solar cell. 5
- d Explain the terms Larmor precession & spin-spin coupling related to NMR spectrum of an organic compound. 5
- e What are light emitting polymers ? Describe the structure of light emitting polymer device & give its any two applications. 5