ABR-1670

Seat No. _____

M. Sc. (Sem. I) Examination

November / December - 2016

CHN-403 (P) - Physical Chemistry : Paper - III

Time : 3 Hours] [Total Marks : 70

instructions : (1) Attempt all questions.
(2) All questions carry equal marks.

1 (a) Write any 02 of the following : 2×5=10

(i) Discuss the solutions of Schrondinger's equation considering hydrogen atom.

(ii) Explain first order and degenerate concept of perturbation theory.

(iii) Define an operator in quantum mechanics and rules for setting up quantum mechanical operator with an example of momentum operator.

(iv) For the first two states, n=1 and n=2 for a particle in one dimensional box of length of L. Find the values of Eigen functions at several values of x between –L/2 and +L/2. Draw the corresponding plots and indicate the symmetry of wave functions.

(b) Attempt any 01 of the following : 1×4=4

(i) The size of nucleus is 10^{-12} cm treating it as a one-dimensional box show why electron does not exist in the nucleus.

(ii) Write a note on variation theorem.

2 (a) Answer any two of the following :

(i) Explain step up ladder operators with examples.

(ii) Discuss term separation energies of the d^n configuration.

(iii) Write a note on extended Huckel theory.

(iv) Discuss orbital and spin motion of subatomic particle like electrons considering angular momentum operator.

(b) Attempt any one of the following : 1×4

(i) Discuss Russel Saunders terms and coupling schemes in general.

(ii) Explain concept of addition of angular momentum considering two sources of angular momentum J_1 and J_2.

3 (a) Do any two of the following : 2×5=10

(i) Define partial molar volume and determine the partial molar volume for a binary mixture using density measurement method.

(ii) Define activity and determine its value using Gibb's Duhem equation method.

(iii) Explain Zeroth law of thermodynamics. Give its mathematical representation and concept of temperature.

(iv) Define phase rule and discuss its various applications.

(b) Attempt any one of the followings : 1×4=4

(i) From a plot of α/RT vs P for CO, the area under the curve between 0 to 100 atm is found of 0.0875 atm dm^{-3} mol^{-1}. Calculate fugacity at 100 atm and 0°C.

(ii) Calculate partial molar volume for 0.2M solution of NaCl using following equation $V=1000 + 35m + 0.5m^2$.

4 (a) Answer any two of the followings : 2×5=10

(i) Define partition function and give physical significance of partition function.

(ii) Derive equation for translational partition function.

(iii) Derive an equation for entropy production in irreversible systems.

(iv) Define irreversible thermodynamics and define its salient features and assumptions.

(b) Do any two of the followings : 1×4=4

(i) Derive an equation for Heat content in terms partition function.

(ii) Calculate the rotational partition function of molecular hydrogen at 0 C. Where $I = 0.459\times10^{-40}$ gm cm^2, $K = 1.38\times10^{-16}$ erg/degree/mole cm, $h = 6.624\times10^{-27}$ erg sec, R=82.06 c.c. atm/deg/mole.

5 Attempt 7 from the following 2×7=14

(1) Spin angular momentum
(2) Normalised
(3) Term symbol
(4) Singlet and triplet excited states
(5) Physical significance of Wave function
(6) Activity
(7) Assembly
(8) Entropy
(9) Internal energy
(10) Microstate
(11) Phenomenological laws
(12) Extensive property
(13) First law of thermodynamics
(14) State variable of system.