[A-87]

SARDAR PATEL UNIVERSITY
T.Y.B.Sc.
B.Sc SEMESTER VI EXAMINATION
WEDNESDAY , 6th APRIL 2016
2.30 to 5.30 pm
PHYSICAL CHEMISTRY: US06CCHE05

Maximum marks : 70

Q 1   MULTIPLE CHOICE QUESTIONS   [10]

1.   In Symmetric top molecules
      a) $I_A = I_B = I_C$ b) $I_A \neq I_B = I_C$
      c) $I_A = I_B \neq I_C$ d) $I_A \neq I_B \neq I_C$

2.   The polarizability due to the alignment of the molecules possessing dipole moment in the direction of the field is called
      a) Electronic polarization   b) Orientation polarization
      c) Atomic polarization   d) All

3.   If for a reaction ΔG is positive the reaction can proceed
      a) spontaneously   b) reversibly
      c) reverse reaction can proceed spontaneously   d) All the above

4.   Cheese is an example of
      a) Sol   b) Gel
      c) Emulsion   d) true solution

5.   The total degree of freedom possessed due to vibrational motion of the linear molecule is
      a) 3   b) 2
      c) 3N - 5   d) 3N - 6

6.   In non polar molecules the electron pair is _____ between two atoms.
      a) Shared equally   a) Shared unequally
      b) Not shared   c) none of the above

7.   The value 76.57 +12.47 ln m + 20.79 ln T is for _____ entropy.
      a) Translational   b) Non linear Rotational
      c) Linear Rotational   d) Vibrational

8.   " The nature of coagulate in lyophobic sol are
      a) Soluble   b) Irreversible
      c) Reversible   d) None

9.   The transitions which do not obey selection rules are called _____ transitions.
      a) allowed   b) forbidden
      c) not allowed   d) permitted

10.   Radioactivity is an example of _____
      a) Colligative properties   b) Additive properties
      c) Physical properties   d) Constitutive properties

Q.2   Answer any Ten   [20]
1.   Define the terms (i) Wagging and (ii) Rocking
2.   Define (i) Peptization and (ii) Reversible sol
3.   Derive the free energy function from calorimetric properties.
4.   List the five physical properties which are employed for investigation of structure.
5.   State the reasons for reduction in the theoretical number of number of bands.
6.   Give reason why the dipole moment of CO_2 is zero while that of H_2O is 1.85 D.
7.   Calculate the translational entropy of 1 mole of Argon gas at pressure of 1 bar, temperature 87.3 K and 2 .(At. wt.of Ar = 39.95 gm).
8.   Give the preparation of $Fe(OH)_3$ and Au sol.
9.   Give reason as to why microwave spectra are measured only in gases and not in solids & liquids.

10. What type of molecules show optical activity. Explain with suitable example what is the meaning of Laevo and dextro rotatory substance.
11. What is the partition function value for linear and non linear rotational molecule.
12. What is meant by Lyophilic colloids . Give the preparation of Lyophilic colloids with suitable example.

Q. 3

a. Give the energy level difference for vibrational - rotational spectra and draw the energy level diagram. [5]
b. HBr has a bond length of 1.40 A°. Calculate the reduced mass , the moment of inertia of molecules, rotational constant . What would be the spacing of spectral lines.(Wt of H= 1 gm & Br = 80 gm) [5]

OR

Q. 3

a. Derive an expression for force constant considering diatomic molecule as simple harmonic oscillator. The fundamental vibrational frequency of CO molecule is 2170 cm^{-1}. Calculate the force constant of CO molecule. [5]
b. The energy of CO_2 molecule is 7.08 X 10^{-4} ergs, determine the wavelength, wavenumber as well as the frequency of the molecule. [5]

Q. 4

a. Define dipole moment & derive the relation between units of dipole moment in C.G.S and SI system. Explain the fact that ethyl chloride which has a dipole moment of 2.05 D is considerably larger than that of chlorobenzene (μ = 1.70 D). [5]
b. A substance of molecular formula C_3H_6O gives the molar refraction of 16.982 $cm^3 mol^{-1}$. Indicate whether the substance is acetone or allyl alcohol. [5]
(R_M C = 2.591, H = 1.028, O in >C =O = 2.573 & O in -OH = 1.518, double bond = 1.575).

OR

Q. 4

a. Define and derive the mathematical formula of (1) Molar Refraction (2)Specific Refractivity (3) Specific rotation (4) Molecular refraction. [5]
b. Calculate the molar refraction values of C & H. Given that molar refraction values of C_7H_{16} = 34.61 cm^3/ mol and C_6H_{14} = 29.96 cm^3/ mol. [5]

Q. 5

a. Derive the standard entropy for (1) Vibrational (2) Rotational (3) Translational motions of the molecule. [6]
b. Calculate the vibrational contribution to the entropy of 1 mole of CO gas at 25°C. The vibrational energy spacing factor is 4.26 x 10^{-20} J. [4]

OR

Q. 5

a. Derive the relationship between the partition functions of the reagents and the equilibrium constants for reactions A → B. [6]
b. Calculate the translational as well as rotational contribution of CO_2 gas at 25°C having moment of inertia 71.7 x 10^{-47} Kg m^2 (At.wt C=12 gm & O = 16 gm) [4]

Q. 6

a. Give the classification of colloids based on physical states and the size of the colloidal particles. [10]

OR

Q. 6

a. What are the methods employed to determine the size of the particles. Explain them in detail. [10]

BEST OF LUCK