6. (a) Show that the equilibrium distribution of particles following Maxwell-Boltzmann statistics is given by : **12,8**

$$N_i = N\frac{gie^{-\beta\in i}}{\sum_i gie^{-\beta\in}}, \beta = \frac{1}{kT}$$

(b) Write in brief on the following :

(i) Statistics a photon gas

(ii) Thermonic emission. **12,8**

Unit IV

7. (a) Derive an expression for entropy production and entropy flow in an open system.

(b) Give an account of entropy production in chemical reactions. **12,8**

8. (a) Describe stream potential and electro-osmosis using Onsagars' reciprocal relations.

(b) Give an account of energy fluctuations in a canonical ensembles.

(c) Write in brief on Saxen's relation. **8,8,4**

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DD300

M. Sc. EXAMINATION, May 2019

(Fourth Semester)

(B. Scheme) (Main & Re-appear)

CHEMISTRY

CH626B

Physical Chemistry Special-IV

(Statistical Thermodynamics)

Time : 3 *Hours*] [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Define and differentiate between microcanonical ensemble, canonical ensemble and grand canonical ensemble.

(b) Give an account of Maxwell Boltzmann law of distribution of energy and evaluation average velocity.

(c) Derive an expression for Maxwell-Boltzmann statistics. **4,10,6**

2. (a) Obtain an expression for heat capacity at constant volume of a system of N independent particles (atoms or molecules).

(b) Define partition function and give its physical significance.

(c) Using the concept of molecular p.f., show that for an ideal monoatomic gas, $P = nRT/V$. **8,4,8**

Unit II

3. (a) Derive an expression for translational entropy of a monoatomic gas in the form of Seckure-Tetrode equation.

(b) Calculate rotational partition function for H_2 molecule at 300 K. Moment of inertia of H_2 is 4.0×10^{-45} kgm^2 and symmetry no. is 2.

4. (a) Establish a relationship between p.f. and equilibrium constant of a chemical reaction.

(b) For CO gas, Q_{vA} = 2.77 K, and Q_{vib} = 3.084 K. For one mole of this gas at 25ºC and 1 atm. pressure, Calculate translational and vibrational p.f. **10,10**

Unit III

5. (a) Derive an expression for Bose-Einstein statistics. Compare it with Fermi-Dirac statistics. State under what conditions the two become equal.

(b) Write short notes on the following :

(i) Gas degeneration

(ii) Specific neat of electron gas. **12,8**