M.Sc. DEGREE (C.S.S.) EXAMINATION MARCH 2015

First Semester

Faculty of Science

Branch : Chemistry

ANIC04/APIC04/ CHIC04/PHIC04/POHIC04—CLASSICAL AND STATISTICAL THERMODYNAMICS

(Common to all Branches of Chemistry)

[2012 Admissions]

Time : Three Hours   Maximum Weight : 30

Section A

Answer any **ten** *questions.*
Each question carries a weight of 1.

1. What is thermodynamics equation of state ? Apply it to an ideal gas equation.

2. What is free energy ? Give temperature dependance of free energy.

3. Explain Konovalov's first and second law.

4. Sketch and explain the graphical representation of one pair of partially miscible liquids.

5. Describe Nernst heat theorem.

6. Write note on thermo osmosis.

7. Explain coupled reactions with suitable example.

8. What is thermodynamic probability ? Obtain the expression of thermodynamic probability.

9. What is partition function ? Give the relation between partition function and internal energy.

10. Derive expression for translational partition function.

11. Write expressions for Bose-Einstein and fermi dirace distribution laws. How does Maxwell Boltzmann's law follow from these ?

12. Distinguish between Bosons and fermions.

13. How is fugacity of real gas determined ? Explain.

$(10 \times 1 = 10)$

Turn over

Section B

*Answer any **five** questions by attempting not more than three questions from each bunch.*
Each question carries a weight of 2.

Bunch 1 (Short Essay Type)

14. What do you mean by excess thermodynamic functions ? Give the experimental determination of excess volume and excess enthalpy.

15. Derive Gibbs-Helmholtz equation. What are its applications ?

16. Derive Maxwell-Boltzmann distribution law.

17. Prove that complete partition function for a system is the product of translational, rotational, vibrational and electronic partition functions.

Bunch 2 (Problem Type)

18. Calculate the free energy of mixing ΔG_{mix} enthalpy of mixing, ΔH_{mix} and ΔS_{mix} at 25°C and 1 atm when ;

    (a) 10 moles of H are mixed with 10 moles of Ne.

    (b) 10 moles of H are mixed with 20 moles of Ne.

    (c) 10 moles of Ne are mixed with 20 moles of equimolar mixture of Ne and He.

19. For Daniel all calculate ΔG, if E = 1.10 V at 25°C and D = 2 ; F 96,500 coulombs.

20. Calculate the translational partition function of a molecule of oxygen gas at 1 atm and 298 k moving in a vessel of volume $24.4 dm^3$.

21. Calculate the translational entropy of gaseous iodine at 298k and 1 atm.

$(5 \times 2 = 10)$

Section C

*Answer any **two** questions.*
Each question carries a weight of 5.

22. Discuss the three component system : $CH_3 COOH - H_2O - CHCl_3$ from the stand point of the phase rule.

23. Discuss the thermodynamic aspects of the following (a) metabolism (b) glycolysis ; (c) biological redox reaction.

24. (a) Derive an expression for fermi Dirac statistics.

    (b) Give comparative account of three statistics.

25. Explain Einstein's theory of heat capacity of solids. How does it differ from Debye theory.

$(2 \times 5 = 10)$