F 7741 (Pages : 2) Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, FEBRUARY 2014

First Semester

Faculty of Science

Branch : Chemistry

ANIC 04/APIC 04/CHIC 04/PHIC 04/POHI C04—CLASSICAL AND STATISTICAL THERMODYNAMICS

[Common to all Branches of Chemistry]

(2012 Admission Onwards)

Time : Three Hours Maximum Weight : 30

Section A

Answer any **ten** *questions.*

Each question carries a weight of 1.

1. Comment on the statement "Entropy of the universe is always increasing".
2. Explain the term fugacity. How is the fugacity of a real gas determined ?
3. Explain how the absolute entropy of a substance can be determined with the help of the third law of thermodynamics.
4. Explain coupled reactions.
5. Depict a phase diagram for two pairs of partially miscible liquids and explain.
6. What are thermodynamic excess functions ? Give the experimental determination of excess volume.
7. What are the Onsagar relation ? Explain.
8. Explain the terms canonical ensembles, occupation number and statistical weight factor.
9. Define partition functions the partition function of system A and B one Q_A and Q_B. The total energy E of the system is $E_A + E_B$. What is the partition function of the entire system ?
10. Derive an equation for the translational partition function.
11. Briefly explain the statistical formulation of third law of thermodynamics.
12. Write short note about supercooled liquids.
13. Explain the limitations of Einstein theory of heat capacity of solids.

(10 × 1 = 10)

Turn over

Section B

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

BUNCH 1 (SHORT ESSAY TYPE)

14. Derive Gibbs Helmholtz equation. Explain its application.
15. Explain the Norst heat theorem. How does it lead to the enunciation of the third law of thermodynamics ?
16. Derive Maxwell–Boltzmann distribution law.
17. Explain the postulates of equal a priori probabilities"

BUNCH 2 (PROBLEM TYPES)

18. Calculate the free energy change which occurs when one mole of an ideal gas expands reversibly and isothermally at 300 K from the initial volume of 5 lines to 50 liters.
19. Calculate the free energy of mixing $\Delta h_{(mx)}$ enthalpy of mixing ΔH_{mx} and ΔS_{mx} at 25°C and later when
    (a) 10 moles of H are mixed with 10 moles of Ne
    (b) 10 moles of He are mixed with 20 moles of Ne
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 298 K and 1 atm.

(5 × 2 = 10)

Section C

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

22. Using the principle of microscopic reversibility show that the cross coefficients are equal.
23. Derive Gibbs-Duhem-Margules equation. Give its importance.
24 (a) Compare Bose- Einstein and formi Dirac statics.
    (b) Derive Bose-Einstein statistics.
25 (a) Derive Sackur-Tetrode equation applicable to monoatomic gas.
    (b) Get expression for free energy and partition function.

(2 × 5 = 10)