F 5118 (Pages : 2) Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JANUARY/FEBRUARY 2017

First Semester

Faculty of Science

Branch : Chemistry

ANI C04/API C04/CHI C04/PHI C04/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 1 *weight.*

1. Write down the expression for thermodynamic equation of state and applied it to an ideal gas.
2. Define the concept of fugacity.
3. State Henry's law.
4. What is the role of ATP in bioenergetics ?
5. What is meant by thermodynamic excess function ?
6. Explain, what is glycolysis.
7. State the principles of microscopic reversibility.
8. What is meant by statistical weight factor ?
9. What is partition function ? How is it factorised into contributing parts ?
10. Define the term "cannonical ensemble".
11. Which of the following are bosons and fermions :

    (a) ^3He ; (b) Alpha particle ; (c) Deuterium ; (d) Hydrogen molecule ; (e) Electron ; (f) Photon.
12. What is characteristic about Fermi-Dirac Statistics ?
13. Explain Debye temperature.

$(10 \times 1 = 10)$

Turn over

Section B

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

Bunch 1 (Short Essay type)

14. Discuss applications of Gibbs-Helmholtz equation.

15. Explain thermoelectric phenomena.

16. Explain Bose-Einstein condensation.

17. Derive Sackur-Tetrode equation applicable to monoatomic gases.

Bunch 2 (Problem type)

18. (a) Calculate the standard entropy change of the reaction $C(s) + H_2O(l) \rightarrow CO(g) + H_2(g)$. Given that entropies are $CO(g) = 197.90\ JK^{-1}$, $H_2 = -328.50\ JK^{-1}$, $C(s) = 5.69\ JK^{-1}$, $H_2O(l) = 70.29\ JK^{-1}$.

    (b) Calculate the standard entropy change of the reaction $Ag_2O(s) \rightarrow 2Ag(s) + \frac{1}{2}O_2(g)$. Given that $Ag_2O(s) = 121.25\ JK^{-1}$, $Ag(s) = 42.67\ JK^{-1}$, $O_2(g) = 205.01\ JK^{-1}$.

19. The free energy charge ΔG accompanying a given process is -85.77 kJ at 25° C. and -83.68 kJ at 35° C. Calculate the change in enthalpy (ΔH) for the process at 30° C.

20. Calculate the ratio of population at 25° C. for energy levels separated by 10 kJ $mol.^{-1}$ The ground state is non-degenerated and the excited state is triply degenerate.

21. Calculate the rotational partition function for hydrogen bromide gas at 300 K. If the moments or inertia of HBr is 3.31×10^{-4} g $cm.^2$ ($K = 1.381 \times 10^{-16}$ erg. deg^{-1} and $h = 6.626 \times 10^{-27}$ erg. sec.)

$(5 \times 2 = 10)$

Section C

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

22. What is meant by thermodynamics of mixing ? Derive Gibbs-Duhem-Margules equation.

23. Discuss about a three component system taking suitable example and give its graphical representation.

24. (a) How did Einstein explain the observed low heat capacities of atomic crystals at low temperature by the application of quantum theory to the problem ?

    (b) What modification are given by Debye to Einstein theory of atomic crystals.

25. Apply Fermi Dirac statistics to understand thermionic emission.

$(2 \times 5 = 10)$