QP CODE: 21002180

21002180

Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, NOVEMBER 2021

First Semester

CORE - CH500104 - THERMODYNAMICS, KINETIC THEORY AND STATISTICAL THERMODYNAMICS

M Sc CHEMISTRY, M Sc ANALYTICAL CHEMISTRY, M Sc APPLIED CHEMISTRY , M Sc PHARMACEUTICAL CHEMISTRY, M Sc POLYMER CHEMISTRY

2019 ADMISSION ONWARDS

4C20F06E

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Represent Maxwells relations.
2. What is the physical significance of fugacity.
3. What are excess thermodynamic functions. Give examples.
4. Define chemical affinity. How is chemical affinity related to the work function?
5. Explain the salient features of graphical representation of Maxwell Boltzmann distribution of molecular velocities.
6. Explain the variation of pressure with time during effusion.
7. Give the expression for Stirling's approximation and discuss its application.
8. What is thermodynamic probability? Obtain the expression for thermodynamic probability.
9. Derive the statistical relation between thermodynamic probability and entropy?
10. Represent the equation for most probable distribution in M-B, B-E and F-D statistics.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Describe a method for the determination of partial molar enthalpy.
12. Describe a method for determining absolute entropies using third law.
13. Derive an expression for collisions in a mixture of gases.

14. (a) Explain Sakur Tetrode equation (b) How is the third law of thermodynamics formulated from statistical thermodynamics?

15. Give an account of the quantum theory of heat capacities of gases.

16. For the reaction $CO(g) + SO_{3\,(g)} \leftrightharpoons CO_{2\,(g)} + SO_{2\,(g)}$ $\Delta G^o = 187.1$ KJ/mol and $\Delta H^o = 184.7$ KJ/mol at 25°C. Calculate (a) ΔG^o at 398 K and (b) K_p at 398 K. Assume that ΔH^o remains constant over the temperature interval.

17. A container of internal volume 22.0 m^3 was punctured and a hole of radius 0.050 mm was formed. If the nitrogen pressure within the vessel is initially 122 kPa and its temperature 293 K, how long will the pressure take to fall to 105 kPa?

18. An argon atom is trapped in a cubical box of side 1 cm. Calculate q_{trans} at 100 K and 10000 K. (1 amu = 1.66×10^{-27} kg)

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Draw the phase diagram of a three component system of three liquids where one pair is partially miscible and explain the application of Gibbs phase rule into it.

20. Derive the expression for RMS, Most probable velocity and average velocity. How are they related? What does each signify?

21. Derive expressions for (a) Vibrational partition function, (b) Rotational partition function and (c) Translational partition function

22. Derive Bose Einstein distribution and its application to liquid Helium.

(2×5=10 weightage)