23003256

QP CODE: 23003256

Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, APRIL 2023

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

50101C6B

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Represent Gibbs Duhem equation and give its applications
2. What is the physical significance of fugacity?
3. Give Gibbs-Duhem-Margules equation and explain the terms.
4. Derive Nernst heat theorem.
5. Define the terms collision frequency and mean free path.
6. Derive the Law of corresponding states.
7. Derive the equation for Stirlings approximation and explain its application.
8. Explains the terms (a)microstates and (b) macrostates with suitable examples.
9. What is meant by residual entropy? Explain using an example.
10. Give the equations for thermodynamic probabilty for 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. Derive vant Hoff's isochore and explain its significance.

12. Describe the phase diagram of hydrate formation of one component in a three component system at constant temperature and pressure.

13. Derive the expression for Root Mean Square velocity and Most Probable velocity. How do the two relate to each other?

14. What are partition functions? Explain its significance. What is the relation between molecular partition function and molar partition function?

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

16. Calculate the free energy change accompanying the compression of one mole of a gas at 57°C from 25 to 200 atm. The fugacities of the gas at 57°C may be taken as 23 and 91 atm respectively at pressures of 25 and 200 atm.

17. The coefficient of viscosity of a gas of molecular weight 28g is 180.0 μ poise at 298 K and 1 atm pressure. Estimate its mean free path.

18. Calculate the q_{trans} for H at 3000 K which is confined to move in a box of volume of 2.5×10^5 cm^3. Also determine the thermal de Broglie wavelength.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. (a) Derive expressions for excess free energy, excess enthalpy and excess volume. (b) Discuss a method for determining excess enthalpy.

20. Derive Maxwell Boltzmann's law of distribution of velocities. How this law is verified? Explain.

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

22. (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?

(2×5=10 weightage)