QP CODE: 22001595

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Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, JULY 2022

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

A267AF7D

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What is meant by thermodynamic equation of state? Mention any one of its applications?
2. What is meant by fugacity? How is it related to pressure of a real gas.
3. Give Vant Hoff's reaction isotherm and Vant Hoff's reaction isochore.
4. What is meant by absolute entropy?
5. Define mean free path and describe its dependence on collision diameter.
6. Deduce the variation of viscosity of a gas with temperature and pressure.
7. Explain (a) thermodynamic probability (b) micro states (c) statistical weight factor.
8. Derive the expression for vibrational partition function.
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. Deduce konovolovs first law from Gibbs-Duhem-Margules equation.
12. Discuss the phase diagram CCl_4- Acetic acid-Water System on the basis of phase rule and what happens to the phase diagram if we alter the temperature of the above system.

13. Derive the expressions for average , RMS and most probable velocities from Maxwell's equation.

14. (a) Discuss the relation between molecular partition function and molar partition function. (b) Differentiate between distinguishable and indistinguishable particles.

15. Explain the classical theory of heat capacities of gases. Discuss its drawbacks.

16. At 300 K the partial vapour pressure of HCl vapour in liquid $GeCl_4$ is as follows:

X_{HCl}	0.005	0.012	0.019
P_{HCl}/K_{pa}	32.0	76.9	121.8

Show that the solution obeys Henry's law and calculate Henry's law constant at 300 K.

17. Calculate the number of collisions between N_2 and O_2 molecules in air at 27°C. The partial pressure of N_2 and O_2 are 0.781 atm and 0.210 atm respectively. The collision diameter of N_2 and O_2 are 370 pm and 360 pm respectively.

18. Calculate the number of ways of distributing distinguishable molecules a , b , c between three energy levels so as to obtain the following set of occupation number, $N_0 = 1$, $N_1 = 1$, $N_2 = 1$.Write the different configurations.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Give different methods for evaluation of partial molar quantities. Illustrate the methods considering partial molar volume.

20. Derive the expression for Maxwell Boltzmann distribution of molecular velocities and discuss the methods for experimental verification of Maxwell Boltzmann distribution.

21. (a) Derive the distribution law as applied to Bosons. (b) Compare Maxwell- Boltzmann statistics with Bose –Einstien statistics.

22. Give an account of Einstein theory of heat capacity of solids. Comment on its limitations.

(2×5=10 weightage)