

Contents

Statistical Mechanics

1. Introduction to Statistical Methods.....	(1-13)
1.1 Introduction	
1.2 Binomial Distribution and Random Walk	
1.3 Binomial Distribution	
1.4 Calculation of Mean Values for the Random Walk Problem	
1.5 Gaussian probability Distributions	
2. Statistical Description of Systems of Particles.....	(14-29)
2.1 Specification of the State of a System	
2.2 Statistical Ensemble	
2.3 Basic Postulates	
2.4 Probability Calculations	
2.5 Behaviour of the Density of States	
3. Microcanonical Ensemble (E, V, N)	(30-34)
3.1 Definition	
3.2 Entropy	
4. Canonical Ensemble (T, V, N)	(35-70)
5. The Grand Canonical Ensemble (T, V, μ)	(71-79)
5.1 Introduction	
5.2 Equilibrium between a system and a particle-Energy reservoir	
5.3 A System in the Grand Canonical Ensemble	
5.4 Relation of statistical quantities with various thermodynamical quantity	
5.5 Illustrative Example	
6. Identical Particle.....	(80-114)
6.1. Kinetic Theory of Gases	
6.1.1 Basic Assumption of Kinetic Theory	
6.1.2 Pressure Exerted by a Gas	
6.2 Gas Law for Ideal Gases	

- 6.2.1 Boyle's Law
 - 6.2.2 Charle's Law
 - 6.2.3 Avogadro's Law
 - 6.2.4 Graham's Law of Diffusion
 - 6.2.5 Ideal Gas Equation:
 - 6.3 Kinetic Interpretation of Temperature
 - 6.4 Maxwell-Boltzmann Distribution Law
 - 6.4.1 The Distribution in Term of Magnitude
 - 6.4.2 To Determine Value of β in Term of Temperature T.
 - 6.4.3 Average Velocity
 - 6.4.4 Root Mean Square Velocity
 - 6.4.5 Most Probable Velocity v_p
 - 6.5 Maxwell-Boltzmann Distribution
 - 6.5.1 Derivation of Maxwell-Boltzmann Distribution
 - 6.6 Energy Distribution Function
 - 6.6.1 Energy distribution in different dimension
 - 6.6.2 Average Energy
 - 6.7 Fermi Dirac Distribution
 - 6.7.1 Fermions at High Temperature
 - 6.7.2 Fermions at Low Temperature
 - 6.8. Bose Einstein Distribution
 - 6.9 The Bose-Einstein Energy Distribution
 - 6.10 Bose-Einstein Gas at High Temperature
 - 6.11 Bose Einstein gas at low temperature
 - 6.12 Bose Einstein Condensation
- 7. Phase Transition and Low Temperature Physics.....(115-140)**
- 7.1 Third Law of Thermodynamics and Attainable of Low Temperature
 - 7.1.1 Production of Low Temperature: The Joule – Kelvin Expansion:
 - 7.2 Phase Transition
 - 7.2.1 First Order Phase Transition

7.2.2 Equilibrium Between Two Phases	
7.2.3 Clapeyron-Clausius Equation	
7.2.4 Liquid-Vapour Phase Transition	
7.2.5 Properties of First Order Phase Transition	
7.3 Second Order Phase Transition	
7.4 Landau Theory of Phase Transition	
7.4.1 Dimensional Analysis:	
7.5 Landau Theory of Second Order Phase Transitions	
7.5.1 Order Parameter	
7.5.2 Free energy expansion	
7.5.3 Minimum Free Energy	
7.6 Ising model	
7.6.1 One-dimensional Ising model	
7.6.2 Renormalization	
7.6.3 One-dimensional Ising chain	
8. Random Walk Problem.....	(141-148)
8.1 Types of Distribution function	
8.1.1 Binomial distribution	
8.1.2 Gaussian Distribution	
8.1.3 Center limit theorem	
8.2 One Dimensional Random Walk Problem	
8.3 Ficks Law	
8.3.1 For Three Dimensional System	
8.3.2 For Two Dimensional System	
8.3.3 For One Dimensional System	
8.4 Langevin Equation	
Questions (Chapter 1 to Chapter 5).....	(149-182)
Solutions (Chapter 1 to Chapter 5).....	(183-219)
Questions (Chapter 6 to Chapter 8).....	(220-255)
Solutions (Chapter 6 to Chapter 8).....	(256-296)