Contents

PAGE

PREFACE v
INTRODUCTION ix

CHAPTER

I. THERMODYNAMIC SYSTEMS 1
1. The state of a system and its transformations . . 1
2. Ideal or perfect gases 8

II. THE FIRST LAW OF THERMODYNAMICS 11
3. The statement of the first law of thermodynamics . 11
4. The application of the first law to systems whose states can be represented on a (V, p) diagram. . . 19
5. The application of the first law to gases 21
6. Adiabatic transformations of a gas 25

III. THE SECOND LAW OF THERMODYNAMICS 29
7. The statement of the second law of thermodynamics. 29
8. The Carnot cycle 31
9. The absolute thermodynamic temperature 35
10. Thermal engines 44

IV. THE ENTROPY 46
11. Some properties of cycles 46
12. The entropy 48
13. Some further properties of the entropy 54
14. The entropy of a system whose states can be represented on a (V, p) diagram 59
15. The Clapeyron equation 63
16. The Van der Waals equation 69

V. THERMODYNAMIC POTENTIALS 77
17. The free energy 77
18. The thermodynamic potential at constant pressure . 82
19. The phase rule 86
20. Thermodynamics of the reversible electric cell . . . 94

VI. GASEOUS REACTIONS 98
21. Chemical equilibria in gases 98
22. The Van't Hoff reaction box. 101
23. Another proof of the equation of gaseous equilibria . 106
24. Discussion of gaseous equilibria; the principle of Le Chatelier 109

CHAPTER PAGE

VII. THE THERMODYNAMICS OF DILUTE SOLUTIONS . . . 113
25. Dilute solutions 113
26. Osmotic pressure 118
27. Chemical equilibria in solutions 123
28. The distribution of a solute between two phases . . 127
29. The vapor pressure, the boiling point, and the freezing point of a solution 130

VIII. THE ENTROPY CONSTANT 139
30. The Nernst theorem 139
31. Nernst's theorem applied to solids. 142
32. The entropy constant of gases 147
33. Thermal ionization of a gas; the thermionic effect . 151

INDEX 157