

Contents

Preface	v	5.3 THERMAL EXPANSION	76
Units, symbols and conventions	vii	5.4 LATENT HEATS	78
1 Temperature	1	5.5 SURFACE TENSION	79
1.1 INTRODUCTION	1	5.6 VAPOUR PRESSURE	81
1.2 SOME BASIC IDEAS	1	5.7 VAPOUR PRESSURE OVER CURVED SURFACES	83
1.3 TEMPERATURE	3	PROBLEMS	86
1.4 SCALES OF TEMPERATURE	4	6 Thermal radiation	90
1.5 THERMODYNAMIC TEMPERATURE	6	6.1 GENERAL NATURE OF THERMAL RADIATION	90
1.6 THE CELSIUS TEMPERATURE SCALE	7	6.2 DETECTORS FOR THERMAL RADIATION	90
1.7 SOME COMMON THERMOMETERS	8	6.3 DISTRIBUTION OF ENERGY WITH WAVELENGTH	92
1.8 THE INTERNATIONAL PRACTICAL TEMPERATURE SCALE	13	6.4 PRÉVOST'S THEORY OF EXCHANGES	93
PROBLEMS	14	6.5 EQUILIBRIUM RADIATION	94
2 Internal energy, heat and work	17	6.6 INFLUENCE OF THE NATURE OF A SURFACE	95
2.1 THE FIRST LAW OF THERMODYNAMICS	17	6.7 THE STEFAN-BOLTZMANN LAW	97
2.2 SOME FORMS OF WORK	20	6.8 WIEN'S DISPLACEMENT LAW	99
2.3 HEAT CAPACITIES	23	6.9 THE BIRTH OF QUANTUM THEORY	100
2.4 CALORIMETRY	26	PROBLEMS	101
2.5 FLOW PROCESSES	29	7 Heat into work	104
2.6 THERMAL CONDUCTIVITY	31	7.1 THINGS THAT DO NOT HAPPEN	104
PROBLEMS	34	7.2 HEAT ENGINES	105
3 The ideal gas	40	7.3 MAXIMIZING THE EFFICIENCY	107
3.1 EXPERIMENTAL LAWS	40	7.4 CARNOT ENGINES	107
3.2 ADIABATIC CHANGES	41	7.5 REAL HEAT ENGINES	109
3.3 BULK MODULUS	42	7.6 VAPOUR PRESSURE	110
3.4 ELEMENTARY KINETIC THEORY	43	7.7 REFRIGERATORS AND HEAT PUMPS	112
3.5 EQUIPARTITION OF ENERGY	47	7.8 THE IDENTITY OF IDEAL GAS AND THERMODYNAMIC TEMPERATURES	113
3.6 ISOTHERMAL GAS IN A GRAVITATIONAL FIELD	52	7.9 ENTROPY	114
3.7 DISTRIBUTION OF MOLECULAR SPEEDS	53	PROBLEMS	116
PROBLEMS	55	A Appendix: More rigorous kinetic theory	120
4 Real substances	60	A.1 DISTRIBUTION OVER DIRECTIONS	120
4.1 MEAN FREE PATH IN A GAS	60	A.2 DISTRIBUTION OVER SPEEDS	121
4.2 THERMAL CONDUCTIVITY IN GASES	61	A.3 FLUX	122
4.3 VISCOSITY IN GASES	63	A.4 PRESSURE	123
4.4 CHANGE OF STATE	64	A.5 THERMAL CONDUCTIVITY	123
4.5 p - V - T RELATIONSHIPS FOR PURE SUBSTANCES	65	A.6 VISCOSITY	124
4.6 NON-IDEAL GASES	66	Useful data	126
4.7 LIQUEFACTION OF GASES	67	Answers to problems	127
PROBLEMS	70	Index	131
5 Interatomic forces	73		
5.1 INTERATOMIC POTENTIAL ENERGY	73		
5.2 ELASTICITY	75		