

# Contents

	Page
<b>Preface</b>	<b>xi</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 Introduction to Equilibrium Thermodynamics</b>	<b>4</b>
Gibbs energy and equilibrium	4
$G-x$ and $T-x$ diagrams	8
Algebraic equilibrium relations	13
Approach 1	13
Approach 2	15
General equilibrium relation	17
Worked examples 2	18
Problems 2	43
References	44
<b>3 Activities and Standard States</b>	<b>45</b>
Standard state 1	46
Standard state 2	50

Standard state 3	51
Standard state 4	52
Summary	53
Worked examples 3	54
Problems 3	64
References	64
<b>4 Thermodynamics of Solids</b>	<b>65</b>
Mole fractions	67
Activity coefficients	71
Worked examples 4	75
Problems 4	87
References	87
<b>5 Thermodynamics of Fluids</b>	<b>89</b>
Aqueous fluids	90
Ions in solution	92
Silicate liquids	98
Worked examples 5	101
Problems 5	116
References	117
<b>6 Equilibrium Thermodynamic Calculations</b>	<b>118</b>
Data	122
Uncertainties	123
Worked examples 6	126
Problems 6	152
References	153
<b>7 Processes 1</b>	<b>154</b>
Nucleation and growth	154
Mass transfer	158
Temperature–time dependence of rate processes	164

Worked examples 7	166
References	171
<b>8 Processes 2</b>	<b>172</b>
Buffering	172
Metasomatism	177
Fractionation	179
Worked examples 8	184
Problems 8	201
References	201
<b>9 Petrological Topics</b>	<b>202</b>
Worked examples 9	202
References	228
<b>Appendix A Thermodynamic Properties</b>	<b>229</b>
Introduction	229
Volume	230
Entropy	231
Enthalpy	234
Gibbs energy	237
Simplifications	238
Approximations	239
Volume	241
Heat capacity	243
Entropy and enthalpy	247
Thermodynamic data	253
References	254
<b>Appendix B A Maths Refresher</b>	<b>259</b>
Some formulae and relationships	259
Solving a set of simultaneous equations	263
<b>Appendix C Standard States for Fluids</b>	<b>265</b>

**Appendix D Solutions to Problems**

**268**

**Appendix E Symbols, Units and Constants**

**279**

**Index**

**281**