Contents

Preface — VII

1	Introduction 1
2	First steps to become a chemistry teacher —— 5
2.1	Required chemistry background — 5
2.2	Beginning as a teacher —— 6
2.3	Roles of a teacher — 7
2.3.1	Feedback —— 10
2.4	First teaching activities —— 10
2.5	Positions in the school during an internship —— 16
2.5.1	Apprentice teacher —— 16
2.5.2	In-service teacher —— 17
2.5.3	Mentor/coach —— 17
2.5.4	Colleagues —— 17
2.5.5	Teaching assistant —— 18
2.5.6	Rest of the school —— 18
2.5.7	Parents — 18
2.5.8	Extracurricular activities —— 18
3	Introducing chemistry in lower secondary schools —— 29
3.1	What is science? —— 29
3.2	What is chemistry —— 32
3.3	Chemical subjects in lower secondary education — 34
3.3.1	Black box —— 34
3.3.2	Properties and the concept of a substance —— 35
3.4	Difficult concepts and alternate conceptions —— 43
4	The process of learning —— 49
4.1	Introduction —— 49
4.2	Early research and thoughts about teaching and learning — 51
4.3	Piaget —— 54
4.4	Vygotsky — 57
4.5	Processing information —— 60
4.6	Learning styles —— 63
4.7	Multiple intelligences —— 65

5	Classroom management —— 69
6	Use of the laboratory —— 77
6.1	Introduction —— 77
6.2	Safety in the chemistry classroom and laboratory — 77
6.3	Goals of practical work in secondary schools —— 85
6.4	Planning practical work —— 87
6.5	Planning inquiry-based experiments — 88
6.5.1	Formulating research questions —— 88
6.5.2	Designing a procedure/experiment —— 88
6.5.3	Observe and record data —— 88
6.5.4	Analyzing data —— 88
6.5.5	Interpreting data —— 89
6.5.6	Conclusions —— 89
6.5.7	Communication —— 89
7	Assessment —— 95
7.1	Introduction —— 95
7.2	Criteria for assessment —— 96
7.3	The position of assessment in the learning process —— 96
7.4	Formulating learning goals —— 98
7.5	Formative assessment —— 101
7.5.1	Introduction —— 101
7.5.2	Techniques of formative assessment —— 102
7.6	Summative assessment —— 109
7.6.1	Introduction —— 109
7.6.2	Design of a summative test —— 110
7.7	Grading summative assessment —— 118
7.7.1	Written exams —— 118
7.7.2	Grading other work —— 121
7.8	Evaluation of a test —— 123
8	Inquiry-based learning —— 135
8.1	Introduction —— 135
8.2	Problem-based learning —— 136
8.3	Context-oriented learning —— 137
8.4	Inquiry-based learning —— 142
9	Chemistry in upper secondary education —— 149
9.1	Prerequisites —— 149
9.2	Mathematical and general science skills — 150
93	Tonics in upper secondary chemistry —— 151

9.4	Some specific issues in teaching chemistry —— 154	
9.4.1	Atomic models —— 154	
9.4.2	Chemical bonds —— 155	
9.4.3	Intermolecular forces —— 158	
9.4.4	Salts —— 159	
9.4.5	Chemical calculations or stoichiometry —— 160	
9.4.6	Equilibrium —— 161	
9.4.7	Acid/base theory —— 162	
9.4.8	Redox reactions —— 163	
9.4.9	Organic chemistry —— 164	
9.4.10	Ethics and chemistry —— 165	
10	Professional development in chemistry education —— 177	
10.1	Teaching —— 177	
10.2	Educational Research —— 183	
10.3	Other tasks within the school —— 183	
References —— 187		
List of figure sources —— 195		

Index ---- 199