

CONTENTS

Acknowledgements *iii*

Introduction **1**

- Background 1
- Vision for Scientific Literacy 1
- Goals for Canadian Science Education 2
- Beliefs about Learning, Teaching, and Assessing Science 2
- Changing Emphases in Science 3
- Processes That Engage Students in Science Learning 5

Section 1: Manitoba Foundations for Scientific Literacy **1**

- The Five Foundations 3
- Nature of Science and Technology 4
- Science, Technology, Society, and the Environment (STSE) 6
- Scientific and Technological Skills and Attitudes 9
- Essential Science Knowledge 12
- The Unifying Concepts 13
- Kindergarten to Grade 10 Science Topic Chart 15

Section 2: Implementation of Grade 11 Chemistry **1**

- The Senior Years Student and the Science Learning Environment 3
- Effective Teaching in Chemistry: What the Research Says to Teachers 14
- Unit Development in Chemistry 17
- A View of Chemistry Education: Toward Modes of Representation 18
- The Modes of Representation 18
- Toward an Instructional Philosophy in Chemistry 25

Section 3: Assessment in Grade 11 Chemistry **1**

- Classroom Assessment 3
- Planning for Assessment 3
- Characteristics of Effective Assessment 4
- Managing Classroom Assessment 8
- Changing Emphases in Assessment 10
- Types of Assessment 11

Section 4: Document Organization **1**

- Document Organization and Format 3
- Guide to Reading the Learning Outcomes and the Document Format 3
- Sample Two-Page Layout 6
- General Learning Outcomes 8
- Cluster 0: Skills and Attitudes Outcomes 10
- Specific Learning Outcomes 13

Grade 11 Chemistry 1

Topic 1: Physical Properties of Matter 1

Topic 2: Gases and the Atmosphere 1

Topic 3: Chemical Reactions 1

Topic 4: Solutions 1

Topic 5: Organic Chemistry 1

Appendices 1

Topic 1 Appendices 1

Appendix 1.1: Demonstrating Diffusion on the Overhead Projector 3

Appendix 1.2: A “Real” Water Fountain 5

Appendix 1.3: Popping the Kernel: Modelling the States of Matter 6

Appendix 1.4: Kinetic Energy Distribution 10

Appendix 1.5: Bond Types and Conductivity 11

Appendix 1.6: Chemistry Review Form 15

Appendix 1.7: Making Fingerprints Visible 16

Appendix 1.8: Probeware Investigation: Determining Melting Points 17

Appendix 1.9: Vapour Pressure with Pop 22

Appendix 1.10: Measuring the Vapour Pressure of a Liquid 24

Appendix 1.11: Forces between Particles 27

Appendix 1.12: Freezing by Boiling 31

Appendix 1.13: Gas Laws: Temperature and Pressure Changes 32

Appendix 1.14: Chemistry Is Super: “Bingo” Review Game 36

Topic 2 Appendices 1

Appendix 2.1: Can You Vacuum Pack a Person? 3

Appendix 2.2: A Historical Timeline of the Measurement of Pressure 4

Appendix 2.3: The Drinking Bird 7

Appendix 2.4: Make Your Own Cartesian Diver 10

Appendix 2.5: Charles’s Law: The Temperature-Volume Relationship in Gases 14

Appendix 2.6: Charles’s Law 16

Appendix 2.7: Charles’s Law Lab 17

Appendix 2.8: Applications of Gases in Our Lives 19

Appendix 2.9: Review Game 22

Topic 3 Appendices 1

Appendix 3.1: Calculating Average Atomic Mass 3

Appendix 3.2: Don’t Be an Isotope: Get the Facts on Isotopes 5

Appendix 3.3: Isotopes Used in Medicine and Climatology 9

Appendix 3.4: The Importance and Application of Isotopes 10

Appendix 3.5: Names, Formulas, and Charges of Some Common Ions 18

Appendix 3.6: Ionic Name Game 19

Appendix 3.7: Stoichiometry: The Formula of a Precipitate 20

Appendix 3.8: Indications of Chemical Reactions 26

Appendix 3.9: Determining the Molar Mass of a Gas 31

Appendix 3.10: Gas Density Table 35

Appendix 3.11: Creative Mole: Writing Activity 36

- Appendix 3.12: The Stoichiometry of Gasoline: Internet Research Activity 37
- Appendix 3.13: How to Solve a Limiting Reactant Problem 38
- Appendix 3.14: The Behaviour of Solid Copper Immersed in a Water Solution of the Compound Silver Nitrate 39
- Appendix 3.15: A Quantitative Investigation of the Reaction of a Metal with Hydrochloric Acid 43
- Appendix 3.16: Stoichiometry: Reactants, Products, and Enthalpy Changes 48

Topic 4 Appendices 1

- Appendix 4.1: Polar and Non-polar Substances 3
- Appendix 4.2: Why Don't Water and Oil Mix? 7
- Appendix 4.3: Constructing a Solubility Curve 8
- Appendix 4.4: Unsaturated, Saturated and Supersaturated Solutions 13
- Appendix 4.5: Crystals and Crystal Growing 15
- Appendix 4.6: Solubility Curve 17
- Appendix 4.7: The Effects of Salt and Antifreeze on the Melting Point of Ice 18
- Appendix 4.8: The Effect of Antifreeze on the Boiling Point of Water 19
- Appendix 4.9: Heat Transfer: I Scream, You Scream, We All Scream for Ice Cream 20
- Appendix 4.10: The Effect of Salt on the Melting Point of Ice 22
- Appendix 4.11: A WebQuest for Solubility Units 25
- Appendix 4.12: Solutions: A Scavenger Hunt 26

Topic 5 Appendices 1

- Appendix 5.1: Underwater Fireworks 3
- Appendix 5.2: Preparation of Esters 6
- Appendix 5.3: Organic Model-Building Presentation 9
- Appendix 5.4: Esters: Flavours and Fragrances 10

General Appendices 1

- Appendix 6: Scientific Communication 3
- Appendix 7: Research 11
- Appendix 8: Assessment 17
- Appendix 9: Developing Assessment Rubrics in Science 23
- Appendix 10: Assessment Rubrics 29
- Appendix 11: General and Specific Learning Outcomes 39

Bibliography 1