

# **Foundations of Chemistry**

## **Applying POGIL Principles**

Fourth Edition

**David M. Hanson**

*Stony Brook University - SUNY*

# FOUNDATIONS OF CHEMISTRY

## Applying POGIL Principles

Fourth Edition

by David M. Hanson  
Department of Chemistry  
Stony Brook University - SUNY  
Stony Brook, NY 11794-3400  
David.Hanson@StonyBrook.edu

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### **Pacific Crest**

906 Lacey Avenue, Suite 206  
Lisle, IL 60532  
630-737-1067  
www.pcrest.com

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# TABLE OF CONTENTS

Acknowledgements .....	ii
Table of Contents .....	iii
To the Instructor and Student .....	v
To the Student .....	vi
<b>Chapter 1: Nature of Chemistry</b>	
Activity 01-1 Units of Measurement .....	1
Activity 01-2 Units Analysis .....	7
Activity 01-3 Significant Figures in Data .....	11
<b>Chapter 2: Atoms and Elements</b>	
Activity 02-1 Atoms, Isotopes, and Ions .....	15
Activity 02-2 Mass Spectrometry and Masses of Atoms .....	21
Activity 02-3 The Periodic Table of the Elements .....	26
<b>Chapter 3: Molecules and Compounds</b>	
Activity 03-1 Molecular Representations .....	30
Activity 03-2 Nomenclature: Naming Compounds .....	34
Activity 03-3 Mole and Molar Mass .....	39
Activity 03-4 Determination of Molecular Formulas .....	45
<b>Chapter 4: Chemical Reactions</b>	
Activity 04-1 Balanced Chemical Reaction Equations .....	53
Activity 04-2 Dissociation and Precipitation Reactions .....	58
Activity 04-3 Introduction to Acid – Base Reactions .....	62
Activity 04-4 Electron Transfer Reactions .....	66
<b>Chapter 5: Stoichiometry of Chemical Reactions</b>	
Activity 05-1 Limiting Reactants .....	72
Activity 05-2 Solution Concentration and Dilution .....	77
Activity 05-3 Solving Solution Stoichiometry Problems .....	81
<b>Chapter 6: Energy and Chemical Reactions</b>	
Activity 06-1 Thermochemistry and Calorimetry .....	87
Activity 06-2 Internal Energy and Enthalpy .....	92
Activity 06-3 Hess's Law: Enthalpy is a State Function .....	98
<b>Chapter 7: Electron Configurations and the Periodic Table</b>	
Activity 07-1 Electromagnetic Radiation .....	103
Activity 07-2 Atomic Spectroscopy and Energy Levels .....	107
Activity 07-3 The Description of Electrons in Atoms .....	113
Activity 07-4 Multi-electron Atoms, the Aufbau Principle, and the Periodic Table .....	119
Activity 07-5 Periodic Trends in Atomic Properties .....	127
<b>Chapter 8: Covalent Bonding</b>	
Activity 08-1 The Chemical Bond .....	140
Activity 08-2 Lewis Model of Electronic Structure .....	143
Activity 08-3 Valence Bond Model for Covalent Bonds .....	155
Activity 08-4 Molecular Orbital Theory .....	158
<b>Chapter 9: Molecular Structures</b>	
Activity 09-1 Valence Shell Electron Pair Repulsion Model .....	165
Activity 09-2 Electronegativity and Bond Polarity .....	174
Activity 09-3 Hybridization of Atomic Orbitals .....	178

<b>Chapter 10: Phases of Matter</b>	
Activity 10-1	Interactions between Atoms and Molecules ..... 183
Activity 10-2	Intermolecular Interactions: Water and Organic Molecules ..... 191
Activity 10-3	Phase Changes in Pure Substances ..... 197
Activity 10-4	Unit Cells of Crystalline Solids ..... 202
<b>Chapter 11: Properties of Gases</b>	
Activity 11-1	The Ideal Gas Law ..... 208
Activity 11-2	Kinetic Molecular Theory of Gases ..... 213
Activity 11-3	Partial Pressure ..... 219
<b>Chapter 12: Properties of Solutions</b>	
Activity 12-1	Solutions ..... 223
Activity 12-2	Colligative Properties ..... 228
<b>Chapter 13: Chemical Kinetics</b>	
Activity 13-1	Rates of Chemical Reactions ..... 234
Activity 13-2	Reaction Mechanisms ..... 243
Activity 13-3	Activation Energy and Catalysis ..... 250
<b>Chapter 14: Thermodynamics</b>	
Activity 14-1	Spontaneous Change and Entropy ..... 258
Activity 14-2	Entropy of the Universe and Free Energy ..... 263
<b>Chapter 15: Chemical Equilibrium</b>	
Activity 15-1	Dynamic Equilibrium and Le Châtelier's Principle ..... 268
Activity 15-2	The Reaction Quotient & Equilibrium Constant ..... 273
Activity 15-3	Free Energy and Chemical Equilibrium ..... 276
Activity 15-4	Solving Equilibrium Problems: The RICE Table Methodology ..... 281
<b>Chapter 16: Acids and Bases</b>	
Activity 16-1	The pH Scale and Water Autoionization ..... 287
Activity 16-2	Relative Strengths of Acids ..... 292
Activity 16-3	Weak Acid – Base Equilibria ..... 300
<b>Chapter 17: Buffers, Titrations, and Solubility Equilibria</b>	
Activity 17-1	Buffer Solutions ..... 308
Activity 17-2	Acid – Base Titrations ..... 312
Activity 17-3	Solubility and the Solubility Product ..... 319
<b>Chapter 18: Electrochemistry</b>	
Activity 18-1	Voltaic Cells ..... 325
Activity 18-2	Electrolytic Cells ..... 333
<b>Chapter 19: Transition Metals and Coordination Compounds</b>	
Activity 19-1	Coordination Compounds: An Introduction ..... 337
Activity 19-2	Coordination Compounds: Magnetism & Color ..... 343
<b>Chapter 20: Organic Molecules</b>	
Activity 20-1	Functional Groups ..... 352
Activity 20-2	Polymer Chemistry ..... 357
<b>Chapter 21: Biological Molecules</b>	
Activity 21-1	Amino Acids and Proteins ..... 363
<b>Chapter 22: Nuclear Chemistry</b>	
Activity 22-1	Nuclear Chemistry: Binding Energy ..... 370
Activity 22-2	Radioactivity ..... 376
Activity 22-3	Rates of Radioactive Decay ..... 380

## TO THE INSTRUCTOR AND STUDENT

Process-oriented guided-inquiry learning (POGIL) is both a philosophy of teaching and learning and a strategy for teaching and learning. It is a philosophy because it encompasses specific ideas about the nature of the learning process and the expected outcomes. It is a strategy because it provides a specific structure for teaching that is consistent with the way people learn, and it leads to the desired outcomes.

The goal of POGIL is to engage students in the learning process, and to help them master the material through conceptual understanding, rather than by memorizing and pattern matching, while developing essential learning skills. Important skill areas for success in chemistry courses, college, and careers are information processing, critical and analytical thinking, problem solving, oral and written communication, teamwork, and metacognition (reflection on learning, self-assessment, self-management, and self-regulation).

To support this goal, POGIL activities utilize a learning cycle design of exploration and concept formation followed by application.

Each activity begins with an *Orientation* that sets the stage for learning. The importance of the activity is described in a *Why?* statement. *Learning Objectives* and *Success Criteria* are identified along with prerequisite activities. The learning objectives describe what the student is expected to learn. The success criteria specify the measurable outcomes of the activity, i.e., what the learner should be able to do at the end. It is quick and easy to make up examination questions simply by looking at the success criteria for each activity.

Students then explore a *Model* in response to *Key Questions*. The model is any representation of what is to be learned. Key questions unlock the information present in the model and reveal its significance. They guide the learner to discover the relevant concepts and to develop an understanding of them. *Information* is provided at the beginning and throughout an activity, but only when a *need-to-know* has been created.

The new knowledge is then applied in simple *Exercises* that build confidence, and then to higher-level applications, called *Problems*, that require synthesis of ideas, transfer to new contexts, and problem-solving skills.

While individual students can complete an activity, the activities are most effective when used by students working in learning teams with the instructor acting as a coach, guide, or facilitator.

Many resources are available to help instructors teach in this new student-centered environment. They can be found at the Pacific Crest and POGIL web sites ([www.pcrest.com](http://www.pcrest.com), [www.pogil.org](http://www.pogil.org)). Both Pacific Crest and the NSF-supported POGIL Project sponsor workshops for faculty to introduce them to process-oriented guided-inquiry learning, assist them in developing facilitation skills, and guide them to materials for use in their courses.

## TO THE STUDENT

Changes in society, technology, and the world economy are occurring at increasingly faster rates. As a college graduate, you will need to be a quick learner, critical thinker, and problem solver to succeed. You will need to be computer literate and skillful in communication, teamwork, management, and assessment. This book is intended for use in courses where faculty are responding to these demands through changes in teaching style and curricula that will actively engage you in learning and help you develop these essential skills.

This book is not like textbooks that you have used before. It does not provide you with information to read, memorize, and repeat during exams. Rather, it provides some representation, or model, of what is to be learned. Key questions guide your exploration of the model, unlock the information present, and reveal its significance. The key questions help you discover the relevant concepts and develop an understanding of them.

Exercises then give you practice at applying these concepts in straightforward situations. They build your confidence in using your new knowledge to solve problems and answer questions. A few problems are included and your instructor will assign others. Problems are not as straightforward as the exercises; they often require the use of two or more concepts and the application of your knowledge in new contexts.

The goal is to help you learn how to process information, analyze situations by asking yourself key questions, construct your understanding of chemistry, and develop the problem solving skills that you need to be successful in this course, in college, and in your career.

You will learn the most and have the most fun if you work on these activities with other students. Discussions among members of your learning team will produce different perspectives regarding the concepts and their use in solving problems. They will identify and correct misconceptions and strengthen and deepen your understanding of chemistry. Use your textbook to resolve disagreements, to find answers to questions that arise, and to see examples of problem solutions. It is through your understanding of the concepts and how to use them that you will be able to answer examination questions and solve real-world problems successfully. When you are working in a learning team, you should have two learning objectives: to understand the material and to assure that every other member of the team understands the material. Explaining ideas and helping others learn are among the best ways for you to deepen your own understanding and knowledge and to gain the insight needed to do well on examinations and apply your knowledge and skills successfully in the real world.

We have found that this approach works for most students. They do better on exams, understand more about chemistry, recognize that they have become stronger learners, and have had more fun along the way.