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VCOAST Method of Problem Solving (Au Help)	(back cover)

Preface: To Students and Instructors

Science students often ask why they are required to study subjects outside their specific field of interest. If your institution is like most, a large proportion of the students in your chemistry class are not chemistry or chemical engineering majors, and may see General Chemistry as one more hoop to jump through on the way to a degree in another major. But, if you look beyond campus, in upper level courses in your major or research labs on campus, you'll find that the separation between sciences is not so tidy as your college catalog would imply. Many scientists actually use a wide variety of tools from other disciplines to solve problems in their specific area. This sort of interdisciplinary approach in science is becoming more common all the time, and it is often necessary to focus on these areas between and across the disciplines to make new discoveries. But, to be able to apply a tool to a new problem is one of the most challenging skills both students and scientists need to acquire.

The intent of *Solving Real Problems with Chemistry* is to help students develop their ability to apply chemistry principles to solve new problems, often within a context that might not seem like chemistry at first. It builds upon a recognized robust pedagogy called Process-Oriented Guided-Inquiry Learning (POGIL) that is widely used to engage students in the learning process and help them master the material through conceptual understanding rather than memorizing patterns for answering traditional questions. It emphasizes building the important skills of information processing, critical and analytical thinking, oral and written communication, teamwork, and metacognition. Extending beyond these fundamental learning levels and skills, *Solving Real Problems with Chemistry* is best used as a follow-up companion to more standard POGIL activities such as those found in *Foundations of Chemistry* by David Hanson (published by Pacific Crest). Activities from *Solving Real Problems with Chemistry* are usually worked by groups of students who are already accustomed to using the POGIL method, and after the corresponding chemistry content has been mastered through the standard activities and other work in the course. We refer to this advanced POGIL pedagogy, which makes use of rich contexts for problem solving, as POGIL-in-Context or POGIL-IC for short.

Each POGIL-IC activity has several parts specifically designed to improve applied problem-solving skills. An **Introduction** to the problem and its context provides important information necessary for appreciating, understanding, and solving the problem. The introduction is followed with the descriptively titled sections **Prerequisite Knowledge, Applying Your New Skills, The Problem, Solve the Problem and Document Your Solution, Does Your Answer Make Sense?, Building Your Problem-Solving Skills, Got It!, and References**, that combine to create the stage for the development of problem solving skills.

The statements in **Applying Your New Skills** connect to the two **Got It!** problems at the end of an activity. These problems give students the opportunity to practice transferring their new knowledge and skills to new situations. The first problem uses the same context as the initial problem but changes the focus. The second problem involves the same concepts but these need to be applied in a new context.

Scientists continually look for ways to validate their work to make sure they are on the right track. **Does Your Answer Make Sense?** guides students in this process, which is an important skill to develop because it can improve performance on exams as students find errors before the exam is submitted for scoring.

Metacognition is the key to improvement. Metacognition literally means thinking about *thinking*, and the section **Building Your Problem Solving Skills** helps students reflect on and think about their problem solving process and how to improve it. This is probably the most important section.

A unique feature of the book is a set of **Help** pages that provide a guided-inquiry approach to solving the problem for each activity. These pages are available to the instructors and facilitators as pdf files, and are

to be distributed to students as needed during the group problem-solving session. The **Help** pages provide a general problem-solving guide for students who need little or no help as gold-level performers (**Au Help**), a set of critical thinking questions that lead silver-level performers to think about the key issues (**Ag Help**), and a more detailed set of questions for copper-level performers (**Cu Help**). In Cu Help, students essentially work as apprentices following an expert problem solver. All the sections after **Solve the Problem and Document Your Solution** are there to develop and reinforce the problem-solving skills required in the activity.

Problem-solving ability develops over time with practice, so using one of these activities after completing a unit of instruction consistently over a semester or year provides students with the practice and reinforcement necessary for improvement. Using these activities in isolation or without standard POGIL pedagogy is not recommended. Sustained use should raise the bar for performance in problem solving, and also provide necessary tools and motivation for improvement.

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