

# LABORATORY MANUAL

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*The University of Alabama*

# CHEMISTRY

## A MOLECULAR APPROACH

Fifth Edition

**NIVALDO J. TRO**



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# Preface

In putting together this laboratory manual for general chemistry, we tried to think about what we experienced as undergraduate students or subsequently as graduate students or chemistry instructors that was most enjoyable and/or illustrative of general chemistry concepts. Chemistry is a hands-on science. Seeing something happen is more educational and powerful than only discussing the theory behind it. Getting into the lab and making something happen (i.e., blowing something up) or making something new is probably the inspiration for most budding chemists. At a fundamental level, chemistry occurs beyond the naked eye, beyond the grasp of most of our senses; but at an experiential level, the concepts can be reinforced by using our senses of sight, touch, hearing, and smell (never taste in the lab).

This is the kind of excitement we are aiming for in this laboratory manual. We want you to see things for yourself and do things for yourself that will emphasize the concepts from the lecture portion of general chemistry. Most laboratory manuals seem to be a tired rehashing of the same material—all but interchangeable. The authors often seem to forget to ask whether the experiment would have been fun or exciting if they were students. Thus, one finds dry “cookbook” laboratory manuals. The “cookbook” label is somewhat unfair because no matter what type of laboratory experiment is being performed (even an inquiry-based experiment), students must be guided through the exercise. A novice observer cannot necessarily be expected to make the important observations without being trained as to what is important to look for.

With this in mind, we attempted to devise a laboratory manual that is concept oriented, has varying levels of guidance from “inquiry-based” to classical “cookbook,” and is hands-on and exciting. Why should your professor in front of the class be the only one to perform the exciting chemistry of the lecture demonstrations? Why not have you throw sodium into water, make things glow in the dark, and mix chemicals to get results you never could anticipate (as in an oscillating reaction)? We also believe that some issues not normally treated in a laboratory to an appreciable degree should be covered, such as the scientific method and scientific ethics. We have attempted to accomplish this with a variety of approaches. Some experiments are “traditional,” of the type you probably performed in high school science classes. Some are open ended. Some are inquiry driven. Some are driven by attempting to obtain an answer close to an accepted standard. Some are based on current events, some on current “sensational” entertainment, and some on history. Through it all, our aim is to present concrete and graspable theories with experiment and example.

Your safety is a major concern. This manual contains some experiments that general chemistry students rarely perform; we have designed these in a careful, controlled fashion so that they are safe. In turn for allowing you to perform some controlled explosions and other experiments, you need to read the instructions carefully, listen attentively to your instructor, and familiarize yourself with all of the safety rules and procedures. The better prepared and careful you are, the more your instructor will feel comfortable letting you perform experiments for yourself.

Have fun and learn.

John B. Vincent and  
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