Keys to Success in Chemistry
(by Grover Everett with editing by F.W. Carson)

Chemistry is typical of most science courses in that you must become skilled in all of the following activities:

- Reading with retention and comprehension
- Memorizing essential facts
- Taking lecture notes
- Understanding abstract concepts
- Solving patterns

In chemistry, most topics build upon previous topics. You must master each topic in chemistry as you proceed or your will soon find yourself in trouble.

It is important to realize that, for the most part, you teach yourself chemistry, and you must learn how to do this effectively.

The instructor's job is to guide you, to help you organize material, to point out what is important, to indicate what must be memorized, to clarify textbook material, to help you grasp difficult concepts, and finally, to evaluate your progress (exams).

Often you may find that you don't understand everything presented in a lecture. Also, some material in your textbook may not make sense the first time (or even the second or third time!) through. This does not mean that you are incapable of learning chemistry or that the lecturer is bad or that the book is poorly written! Sciences such as chemistry frequently require hard thinking and repeated efforts to understand concepts.

The most basic study skills are **time management** and **organization**. Successful student are those who are organized: they plan ahead, and they make efficient use of their time. It is best to study chemistry every day. Make use of small chunks of time – even 10 or 15 minutes on the bus, between classes, waiting, etc. – for "low level" activity such as memorization or initial scanning of assigned reading.

For more difficult work, such as careful reading, understanding concepts, or working problems ("high level" activity), choose a place where you are most inspired and least disturbed and choose a time of day when your energy level is high and you are most alert.

When studying, begin with a positive attitude. Be aggressive with difficult problems or concepts and don't give up easily. Be efficient – study hard then take a complete break rather than drag it out at 50% effort. Studying with others can be beneficial at times: e.g., reciting memorized material, discussing concepts, making up anticipated exam questions. However, when solving problems it may be best for you to give them a real effort on your own before seeking help. It is easy to believe that you understand something when someone else shows you, but you don't

really have a solid grasp of the concepts and methods until you can solve the problems on your own (as on an exam).

Let's look further into each of the five activities listed above:

1. **Reading**: In a chemistry textbook there is relatively little "filler" material. Most paragraphs contain at least one concept or its application that you must understand. Thus, reading should be done slowly and with active mental processing, a "high level" activity. Think about each sentence; do a "**reality check**":

   A reality check is a mental process whereby you question a statement for reality. Does it make sense? Does it fit in with what you already know?

   After reading a paragraph, ask yourself, "What are the important points here?" You may want to summarize these in the margin of the book. When underlining or highlighting key words, be very selective as if choosing words for a telegram. (Some students highlight nearly every word, but this defeats the purpose of highlighting!)

   You will benefit much more from lectures in chemistry if you read assignments in advance of lecture rather than afterwards.

2. **Memorizing:** In chemistry, a certain amount of material must be memorized. There is no way to avoid this. However, **verbatim** memorization of definitions is not necessary! It is far more important to understand the meaning of the word and to be able to construct your own definition. Try to visualize the ideas rather than the words.

   The key to retention of memorized information is proper storage within your brain. As in any filing system, things must be stored in a logical order if they are to be retrieved easily.

   Thus you should try to find some logical organization of the material to be memorized - - try to fit it into a framework, relating to it something with which you are familiar. [In chemistry, the Periodic Table of Elements is one such framework.]

   The process of organizing materials, finding familiar frameworks or mnemonic devices is a study activity that sets up mental pathways for easier memorization.

   Once you have memorized a body of information, you must make sure that it will be retained in your brain. This is important because it has been shown that after initial memorization, 30% is lost in 1 day and 90% is lost in 1 month unless the memory is reinforced. There are 2 good ways to ensure retention of memorized material:

   a. Frequent Repetition – brief, frequent reviews, particularly physical (verbal, written) recitations.
   b. Cross referencing – a form of reality check whereby you try to connect new material with other related material in your memory. The higher the degree of cross

referencing in a filing system, the faster and easier it is to retrieve a particular piece of information.

3. **Taking lecture notes:** Among the responsibilities of the lecturer are: pointing out what material is important and helping you to organize the material in a logical manner. You should take notes on this, and they should be neat and accurate.

   Take notes even if you don't fully understand the material being presented. You will probably be able to interpret your notes after further study.

   There is no need to write down everything presented, especially if it is given in your textbook. (This is one reason for reading the textbook prior to lectures!)

   Some students recopy their notes after each class. This can be an active learning process if you **think** about the material (reality checking) as you copy. It also gives a neater set of notes to study.

4. **Understanding Concepts**: This is the most difficult part of chemistry for most students, but it is the most important. Some concepts require strenuous mental effort and repeated attempts.

   It often helps to devise a mental physical picture involving the concept. [For example, you might think of atoms as tiny, fuzzy spheres of various sizes. For a particular element, all the spheres are identical. In a compound, different spheres are joined together.] A responsibility of the lecturer is to help you with the concepts. If you have a good understanding of the concepts, problem solving will be much easier.

5. **Problem Solving:** This is the ultimate test of your overall knowledge and understanding of chemistry. It is a generally a "high-level" activity in which you must bring together your understanding of concepts plus learned material and your previously- acquired math skills.

   The more problems you work, the easier it becomes to solve problems, because you establish patterns of analytical thoughts processes through repetition. Problem solving also "firms up" and illustrates concepts and learned materials.

   The best way of learning how to solve problems is by careful attention to examples worked out in class and in the textbook. Analyze the sequence of steps used to solve the problem. Ask yourself, "Why was it done this way?"

   Make sure you understand each step in a worked example.

6. **Reviewing for Exams:**
   Frequent review ensures retention of learned material. Review until you feel **confident**. This allows you to relax at exam time and to avoid fear of failure. Start early – don't depend upon cramming the night before!

- Review highlighted items and marginal notes in your textbook.
- Review all lecture notes initially, then, on the final review, focus on items with which you have the most difficulty.
- Re-work as many of the assigned problems as time allows. Solving problems and writing out memorized material or answers to questions forces your brain to **produce** and **process** the information rather than simply recognize it.
- Make up and give yourself practice tests. Anticipate the instructor's exam questions. This forces you to think about what you have learned.

It is highly recommended that you keep this KEYS TO SUCCESS IN CHEMISTRY in your notebook. Read it again in a few weeks! Many of the suggestions made here will be much more meaningful after you have experienced part of a college-level chemistry course. Also, you may find that these suggestions apply to other courses you are taking or plan to take.