CollegeBoard AP
connect to college success™

IMPORTANT NOTE:

The AP® Course Audit

The syllabi included in this *Teacher's Guide* were developed prior to the initiation of the AP® Course Audit and the identification of the current curricular and resource requirements. These syllabi contain rich resources and will be useful in generating ideas for your AP course. In addition to providing detailed course planners, the syllabi contain descriptions of classroom activities and assignments, along with helpful teaching strategies. However, they should not necessarily be used in their entirety as models that would be authorized under the guidelines of the AP Course Audit. To view the current AP curricular and resource requirements and examples of syllabi that have been developed since the launch of the AP Course Audit and therefore meet all of the requirements of the audit, please visit AP Central®.

http://apcentral.collegeboard.com/courseaudit/resources

060082030

CollegeBoard
Advanced Placement Program

AP® Chemistry

Teacher's Guide

William B. Bond
Snohomish High School
Snohomish, Washington

connect to college success™
www.collegeboard.com

The College Board is a national nonprofit membership association dedicated to preparing, inspiring, and connecting students to college and opportunity. Founded in 1900, the association is composed of more than 3,800 schools, colleges, universities, and other educational organizations. Each year, the College Board serves over three million students and their parents, 22,000 high schools, and 5,000 colleges, through major programs and services in college admission, guidance, assessment, financial aid, enrollment, and teaching and learning. Among its best-known programs are the SAT®, the PSAT/NMSQT®, the Advanced Placement Program® (AP®) and, Pacesetter®. The College Board is committed to the principles of equity and excellence, and that commitment is embodied in all of its programs, services, activities, and concerns.

Table of Contents

Preface

This third edition of the AP Chemistry Teacher's Guide represents the efforts of many who are committed to providing the best possible college-level chemistry instruction to high school students. Since the last edition, there have been advances in technology and theories of instruction that have resulted in new ways of teaching chemistry. This guide intends to provide an updated and fresh approach to educational theory as well as a description of the mechanics of teaching a college-level course in a high school setting.

Like the one before it, this teacher's guide contains useful information and helpful resources for teachers of AP Chemistry, both the experienced and the novice. Features of special interest include

- A look at the way introductory chemistry is being taught in colleges and universities and how both content and process are changing, written by Dr. James N. Spencer, a professor of chemistry at Franklin and Marshall College in Lancaster, Pennsylvania.

- A discussion of the responsibilities and rewards of offering and participating in the AP Program.

- A description of some of the nuts and bolts of designing and teaching an AP Chemistry course.

- Suggestions for using multimedia resources and technological equipment to enhance the AP Chemistry course, written by René McCormick, an AP Chemistry teacher at Carroll High School in Southlake, Texas.

- New syllabi from internationally proven and successful AP Chemistry courses, written by eight high school teachers and two university professors.

It should always be remembered that this is a guide that provides ideas. Teachers are encouraged to use these ideas as just that — ideas — and to be innovative and creative in the ways in which they put them into practice in their own classrooms.

Talented students today have a variety of options for doing advanced chemistry while still in high school; for many, AP Chemistry is the best of these options. The AP Program in general, and the AP Chemistry program in particular, play an important role in educating and preparing students for the future. I have found teaching AP Chemistry to be a demanding, exciting, and rewarding enterprise. It has been one of the greatest experiences of my professional career, as I hope it will be for yours.

William B. Bond
Snohomish High School
Snohomish, Washington

I. Introduction

Most of the students who take AP Chemistry in high school will probably be interested in pursuing a science major or taking a pre-med sequence of courses in college. In contrast, more than 90 percent of the students in most introductory chemistry courses in college will not be chemistry majors; a number will be biology, physics, or perhaps geology majors. Many institutions offer a general science course that covers several areas, such as chemistry, physics, and biology, within the same course. This type of course is designed for students who do not intend to pursue a science major but must fulfill a science requirement. General science courses are not addressed in this survey of trends and directions for general chemistry college courses.

New Directions in General Chemistry: How Recent Research Is Changing the Introductory Chemistry Course

The college general, or introductory chemistry course has been a topic of debate for at least 100 years. At the beginning of the 20th century, the primary question was when to teach qualitative analysis. General chemistry at that time was essentially descriptive inorganic chemistry; no principles or themes were used to organize the material. In the 1920s, the discoveries in atomic structure resulted in a new theoretical basis around which the course could be organized, and a significant change in teaching occurred. In the 1950s and 1960s, the teaching of general chemistry underwent further change — additional material was added and the course became more mathematical. Over the past 30 years no major national changes have taken place in the way general chemistry at the college level is taught (Lloyd, 1992).

Another aspect of this debate, how to teach the laboratory part of the course, also began at the turn of the century and continues unresolved today. At the core of the discussion is this question: Should the laboratory be used to train students in analysis and instrumentation or should students learn how to use the laboratory to create and test knowledge and discover themes and patterns in the data? In some contemporary laboratory programs the emphasis is on the reproduction or verification of the results indicated by the instructor or the textbook. Other laboratory programs require students to develop a hypothesis, design experiments to test the hypothesis, collect data, and interpret data to confirm or refute the hypothesis.

The General Chemistry Course: Its Content

Today, there is still no common consensus on what areas of study should constitute the general chemistry curriculum. Traditionally taught in the first two semesters, the general chemistry course at the typical college or university covers a wide variety of topics and subject matter. Its content continues to be largely predicated by both the requirements of the chemistry major and the instructor's area of expertise. A further problem is created by the amount of time that is required to cover all of the content, which leaves process either shortchanged or ignored.

An ETS study of colleges and universities with large numbers of former AP Chemistry students concluded that 1) the introductory chemistry course was crowded with respect to the number of topics and 2) the number of topics exceeded what students could be expected to learn (Taft, 1990 and 1997). The most commonly included topics, such as stoichiometry, the structure of the atom, Lewis structures, VSEPR, hybridization, gas laws, acids and bases, equilibrium, thermodynamics, redox, and kinetics, would by themselves constitute a large part of the chemistry major. Many of the topics and concepts are presented because custom and tradition seem to demand them. Four of the concepts considered most important in general chemistry today (formulas, moles, properties of matter, and acid-base and ionic equilibria) were also suggested in 1927 (Lloyd, 1994). Some material, in an effort to get it into the course, has been watered down to the point of being if not incorrect, then misleading at best. Add to all this other, less common topics, for a total of more than 100 different topics, and the magnitude of the difficulty of deciding what should be in the general chemistry course becomes apparent. Calls to reexamine the content have not produced a significant change in the course offerings.

The Chemistry Teaching Tradition: Stasis and Shifts

The teaching paradigms that can be found in most chemistry classrooms today are the discipline-centered and instructor-centered models. In a discipline-centered classroom, the departmental syllabus determines the content and hence the process. The instructor-centered model (in which the teaching of science has its origins) is based on behaviorism. Behaviorism puts the instructor at the center of learning and maintains that students are willing receptacles into which knowledge is poured; or to put it another way, teaching consists of telling (Robinson, 1998). A third teaching paradigm — the student-centered model — has only recently emerged. In a student-centered classroom, process stimulates student inquiry; the teacher serves as a mentor who guides students as they construct their own knowledge.

In part because of the emphasis that is placed on content, discipline- and instructor-centered classrooms remain the norm in the majority of first-year college chemistry courses. Class size, the amount of material to be covered, and the necessity of addressing the needs of the major are often cited as reasons for being unable to move away from the noninteractive role students traditionally play in the science classroom. Bruce Alberts, president of the National Academy of Sciences, has observed that we teach as we ourselves were taught, which in part accounts for the persistence of the behaviorist model. In order to be effective in teaching science as an inquiry-based process, he says, teachers need to experience inquiry themselves (Committee, 1997).

Recent research provides a strong argument for changing the way in which chemistry is taught. Studies have shown that students have different learning styles, some of which do not match that of their instructor. It is now believed that active students learn more than passive students and that all students do not need the same level of knowledge in chemistry. Alberts has noted that "research has taught us a great deal about effective teaching and learning in recent years, and scientists should be no more willing to fly blind in their teaching than they are in scientific research, where no new investigation is begun without an extensive examination of what is already known." (Committee, 1997)

As a result of our growing understanding of the ways in which students learn, the winds of change (probably better described as gentle breezes) are blowing. With the encouragement of hundreds of teachers and many organizations, including the American Chemical Society (ACS), the National Academy of Sciences, and the Pew Higher Education Roundtable, science instruction is gradually beginning to move away from the discipline- and instructor-centered models to a student-centered model, away from an emphasis on providing instruction to an emphasis on producing learning.

According to Paul Walter, president of the ACS in 1998, teachers can

> step down from their role as omniscient dispensers of truth to be memorized and serve instead as facilitators of discovery on the part of the students. In fact, the "inquiry-based" approach to learning chemistry has become the norm at our best schools and is built into the *National Science Education Standards*. At the Biennial Conference on Chemical Education held recently in Waterloo, Ontario, I heard papers from high school and college teachers where they shared experiences and ideas on how to implement "inquiry-based" education at their level. If you have never attended one of these events, I urge you to do so. You will leave there a changed person. At the secondary level, I see us further extending inquiry-based education, so that not only the best of our teachers, but all of our teachers will use it. *(Walter, 1998)*

The Pew Higher Education Roundtable also gives strong support to a student-centered approach to the teaching of science: "Today, there is a broadly shared consensus that students learn best in a hands-on, inquiry-based approach to scientific discovery, and there is a growing conviction within the profession that science curricula ought to reflect this understanding." (*Policy Perspectives*, 1998) The same report notes, however, that the instructor-centered model of teaching has not yet succumbed to the winds of change, observing that "the changes in teaching that have occurred have usually focused on the content and not the role of the teacher in facilitating learning; while some do apply electronic technology to promising ends, the basic paradigm of teaching and learning for the most part has not changed."

Some institutions are easing into a new way of teaching chemistry by changing their sequencing of the first two years of beginning chemistry courses. Traditionally, what is called general chemistry is taken during a student's first year in college and is followed by two semesters of organic chemistry in the second year. Some programs have changed this order of presentation by beginning with one semester of general chemistry, following with two semesters of organic chemistry, and then returning to a final semester of general chemistry. That this sequence is usually taught by traditional methods indicates the state of flux at the college and university level — change and no change is occurring all at the same time.

The Changing Course

If the introductory course is to become more tractable to students, if the best learning environment possible is to be provided, then changes must be introduced in both its content and the way the it is taught. As more and more educators are becoming aware of the recent research, this is precisely what is happening. Individual teachers and national organizations are responding to the challenge in new and innovative ways, and by doing so, both have become part of the move toward changing course content and teaching styles.

Teachers all over the country and in a variety of teaching situations are creating new courses independently of each other. This development of experimental general chemistry courses has been described as a cottage industry because it is being done by individuals who are not acting under the guidance of a single entity. As their ideas and discoveries are published and shared at regional and national conferences, it has become evident that there are nearly as many approaches to the course as there are topics in the course. The almost endless list includes

- blended courses based on the idea that general and organic chemistry can serve to reinforce each other
- courses that are primarily organic chemistry
- courses that use workshop chemistry in which students serve as tutors and mentors for groups of fellow students
- cooperative learning environments
- lectureless courses
- students teaching students
- guided inquiry classrooms
- discovery labs
- laboratory-centered instruction
- interactive lecture tools such as ConcepTests
- problem-solving instructional methods
- computer-based instruction
- teaching through demonstrations
- course clusters

Of the national organizations that are actively promoting change, the National Science Foundation (NSF) is perhaps one of the most visible. Various projects supported by the NSF have focused on student-active learning strategies. The basis for these approaches to reforming the general chemistry course is the knowledge that students learn best when they 1) have hands-on experience with a chemical application that is relevant to them and 2) can construct their own knowledge. The NSF works with five consortia comprised of liberal arts colleges, community colleges, public and private institutions, and large research institutions across the country, who, despite different methodologies, have adopted similar guiding pedagogical principles.

The NSF supports numerous projects that are intended to instigate systematic changes in the undergraduate chemistry curriculum. NSF projects have resulted in the development of active-learning strategies for students based on cognitive research and include such new tools as computer use and interactive texts and multimedia for supplementary instruction. Modules have been produced that develop data analysis, problem-solving, and communication skills in addition to addressing topics of interest to students. Now available through the consortia are inquiry-based laboratory exercises and interactive methods that can be used in large university settings as well as in smaller college and university classrooms.

Born out of an interest to introduce students to the process of scientific investigation, laboratory experiences have perhaps undergone more change than the lecture part of the course. In the discovery, or guided inquiry laboratory students are asked to develop a hypothesis and a means of testing it. They then carry out experiments and collect sufficient data (often pooled) to allow the hypothesis to be accepted or rejected. The goal is for students to discover a concept for themselves. Teamwork is emphasized, and the ability of students to recognize threads and patterns in data is of importance in this type of laboratory.

Computers and the Internet have become a presence in most general chemistry classrooms. Students now use computer technology for quick graphing and interpretation of data. Other software enables them to carry out molecular modeling to help in their visualization of a structure or to permit the calculation of other relevant molecular parameters. They use data obtained from the Internet in their interpretation of experimental results, and teachers turn to web sites when they need supplemental information.

Textbooks are also changing. Not only are they becoming shorter and less encyclopedic, but now they include new approaches to traditional topics. Some texts come with CD-ROMs and some texts *are* CD-ROMs.

The Future of General Chemistry

What does all this turmoil over content and the way it is taught mean for the future of the general chemistry course? How can a high school teacher design his or her AP Chemistry course to be the equivalent of a college-level general chemistry course at a time when that course's very content and the way it is taught are being questioned and changed? AP Chemistry teachers, who may be understandably concerned about how best to prepare their students to be successful in a first-year college chemistry course, are encouraged to take the following two important ideas with them into their classrooms.

First, the change in the pedagogy and philosophy of teachers of college chemistry is based on how students learn. Discipline- and instructor-centered education are giving way to student-centered learning. The latter approach emphasizes greater student engagement in the learning process in both the classroom and the laboratory. Critical thinking skills are emphasized and student mastery of these skills is considered much more valuable than the rote memorization of material. It is now recognized that students at the beginning level rarely have the Piaget maturity to be able to deal satisfactorily with such abstractions as Schrödinger's formulation of quantum mechanics or thermodynamic subtleties. More important is the development of a student's ability to create knowledge from data or information and develop the methodology needed to test that knowledge.

Numerous studies (please see the "Works Cited" section for references to these) have shown that students who have learned to reason critically in student-active classes do as well as or better than traditionally taught students on examinations that are also traditionally based. What this means is that the development of learning patterns and processes is more likely to stay with students than the information they have crammed for an examination. This is no great revelation; teachers have always known this, but until now it has never received sufficient recognition to prompt a change in the way science is taught.

Second, the teacher remains the single most important aspect of the learning environment, because it is the teacher who sets the agenda and decides on the pedagogical style that is most consistent with his or her personality and the goals of the class. Classroom studies have shown that the teachers who are most usually identified by students as "good teachers" are the ones who convey their enthusiasm for the subject and concern for their students while providing a challenging and engaging environment. These instructors know it is not the quantity of material that is covered but the learning that is produced that is critical; they know that the student who goes on to general chemistry in college will benefit most from a basic understanding of chemical principles and least from memorized algorithms and theoretical constructs that are too difficult for visualization or comprehension by beginning chemistry students.

The steady advance of increasingly more sophisticated subject matter into the course has left some high school teachers questioning their expertise in certain topics. Yet a teacher can provide a firm grounding for students in those areas he or she feels more confident in and not be unduly concerned over the omission of some material. Students who have been given the opportunity to develop self-reliance and to learn how to learn will do just fine as beginning chemistry students in college.

James N. Spencer
Department of Chemistry
Franklin and Marshall College
Lancaster, Pennsylvania

Works Cited

Committee on Undergraduate Science Education. *Science Teaching Reconsidered.* Washington, DC: National Academy Press, 1997.

Lloyd, Baird W. "Review of Curricular Changes in the General Chemistry Course during the Twentieth Century." *Journal of Chemical Education* 69 (1992): 633-636.

_____, e.d. *New Directions for General Chemistry.* Washington, DC: Division of Chemical Education of the American Chemical Society, 1994. Limited copies of this guide, prepared by the Task Force on the General Chemistry Curriculum, are still available. Contact James N. Spencer, Department of Chemistry, Franklin and Marshall College, Lancaster, PA 17604; j_spencer@acad.fandm.edu.

Policy Perspectives 8, no. 1 (June 1998). This is published by the Institute for Research for Higher Education, 4200 Pine Street, 5A, Philadelphia, PA 19104-4090; (215) 898-4585, (800) 437-9799.

Robinson, William R. "New Paradigms, New Techniques, New Texts." *Journal of Chemical Education* 75 (1998): 1528.

Taft, Hessy L. "Content Validation Studies of the AP Chemistry Examination." *Journal of Chemical Education* 67 (1990): 241.

_____. "National Curriculum Survey of College General Chemistry." *Journal of Chemical Education* 74 (1997): 595-599.

Walter, Paul H. L. "Perspectives of the ACS President." *Journal of Chemical Education* 75 (1998): 1532.

II. How to Begin an AP Course in Chemistry

There are many ways in which chemistry teachers become involved in an AP Program. They may have heard about it, and the AP Chemistry course specifically, from colleagues or literature, or done some investigating on their own and then presented a proposal to start such a course to the officials in their school district. They may have had previous experience teaching AP Chemistry, recognized the course for its strengths, and become enthusiastic proponents for its introduction in their new school. In some cases, school district officials may have made a commitment to the teaching of AP Chemistry and then looked within the existing ranks of the faculty for a willing and able teacher. In this case, the chosen teacher may have been encouraged to become involved in the program without being fully aware of the extent of the commitment he or she was making.

Successful AP programs require a team effort between school officials, teachers, students, and parents. There are many advantages to offering and participating in AP Chemistry, but with these advantages come responsibilities and commitment from each member of the team. It is unrealistic to expect success if only one or two of the team members are enthusiastic supporters. In a strong program, everyone works together for the benefit of the students; everyone must be committed.

Supporting a Successful AP Chemistry Program

The school district must have an ongoing commitment to its AP Program. It must not commit funds to begin an AP Program and then, when the political climate changes, withdraw that support to concentrate its attention on other areas instead. School district officials need to realize that AP Chemistry has unique aspects that require a special commitment. An AP Chemistry program cannot remain strong unless teacher training is ongoing, specialized equipment and materials are replaced or updated, and the extra effort of everyone involved is recognized and rewarded.

One of the first steps of beginning an AP Chemistry course is finding an enthusiastic and qualified teacher to teach it. This should be someone who has a strong academic background in chemistry, successful experience in teaching science, and an unqualified commitment to the program. It is not in a school's best interest to force an unwilling or hesitant teacher into this kind of undertaking. The new AP Chemistry teacher will have to work very hard for several years to establish the course and must be supported in terms of teacher training, release time for preparation, and financial compensation if any extra hours of teaching are involved. Teacher training should involve the completion of at least one week-long AP Summer Institute prior to the introduction of the course. School officials and teachers should follow this up with one-day workshops throughout the year, particularly during the first few years after the course has been introduced. The school should also designate an AP Coordinator who will work closely with the AP Chemistry teacher, especially while the course is still new.

The school should provide its AP Chemistry teacher with facilities comparable to those found in chemistry labs for college freshmen. An AP Chemistry lab should have

- chemically resistant lab benches
- easy access for all students to gas, electricity, and water
- storage cupboards for equipment
- fume hoods for ventilation
- a preparation room for the storage of chemicals
- adequate space for equipment set-up and lab work

This last provision is important. Obviously, spatial needs will vary with class size, but adequate lab space is essential. It may be necessary to redesign existing facilities to make them adequate for this level of lab work. For a definition of "adequate space," school officials and AP Chemistry teachers may refer to a number of sources, including the Flinn Chemical and Biological Catalog Reference Manual. The Flinn catalog contains not only products for high school chemistry courses but also brief articles that cover such topics as lab safety; "Right to Know" laws; and chemical inventory, storage, and disposal.

AP Chemistry requires a considerable amount of specialized equipment, which more than likely will not be present in an existing science department. Equipment needs range from calculators with probes and modern computers with printers to volumetric glassware, pH meters, and analytical balances. A school should not try to compromise on these requirements. There are too many necessary lab experiences in an AP Chemistry course that are unsafe or impossible to conduct in a poorly equipped environment.

School officials may find AP Chemistry restrictive in terms of scheduling; but there is no substitute for time spent in class and this, more than anything else, should not be compromised. As described in the *Advanced Placement Course Description: Chemistry* (frequently referred to as "The Acorn Book" because of the acorn logo on its front cover), students should spend a minimum of 290 minutes each week in scheduled class time, including a minimum of 90 minutes of lab, preferably in one session. This may necessitate double periods or other creative scheduling that could impact the general school schedule and give students fewer choices regarding electives. Class size also needs to be considered. Regardless of space, the class should be limited to 25 students — less for the first year the course is introduced.

The success of an AP Chemistry course depends on the strength of the courses students have taken in preparation for it. These should include advanced math courses as well as honors science courses, if they are offered. The preparatory courses must be demanding and rigorous both in terms of their workload and the higher thinking skills they require. AP Chemistry must be a second-year course that is offered to students only after they have successfully completed their first-year chemistry course. Keep in mind that a successful AP Chemistry course is a reflection on the entire AP Program, not an individual course.

A school should be prepared to make tough decisions concerning enrollment in its AP Program and then stand by them for the good of those students who are well prepared and seriously motivated. AP Chemistry is truly a college-level course with many checks to ensure that it remains so. The program must not be compromised by lowering its standards to cater to ill-prepared students who may desire enrollment merely to brighten up their transcripts rather than to be challenged by college-level work. The school should select which students will participate in its AP Program, taking into consideration each student's past academic performance, standardized test scores, maturity, ability to make the necessary time commitment, and desire. Some students may have to be denied entry or asked to wait to take the course until they are better prepared.

In return for the tremendous commitment described in this section, the school district that decides to establish an AP Program will have the satisfaction of knowing that it has truly challenged the best and brightest students in its community. It may even serve as a magnet to outstanding students throughout its area. These students, who might have been tempted to go elsewhere for college preparation, will choose to remain enrolled in a high school that offers college-level work. They will be school leaders who will serve as role models to the other students. It would be a tragedy for a school to lose them because it could not offer the level of study they need and desire. In some cases, schools may find they qualify for additional funding because they offer an honors program including AP Chemistry.

The shortage of qualified high school science teachers that is developing in many areas of the country provides an additional reason to establish a solid AP Chemistry program. If this shortage continues, there will be competition between schools not only for the top students but also for the best teachers. Since most science teachers find it greatly satisfying to teach the "best and brightest" students by means of a challenging curriculum, it is in a school's best interest to institute and maintain a strong academic program, such as the AP Program, to attract and retain the most qualified and talented faculty.

Being an AP Chemistry Teacher

The teacher who is selected to teach an AP Chemistry course must be willing to make additional commitments and assume more responsibilities. Without question, an AP Chemistry course requires more of a teacher's time, both inside and outside of class; an AP Chemistry teacher cannot expect to adhere solely to official school building hours *and* have a quality program. The teacher's workload will greatly increase: detailed lab reports and essay-type exams must be graded, meaningful labs must be prepared, help must be given to struggling students before and after school, and letters of recommendation to colleges must be written. All of this extra effort may be without additional monetary compensation. In addition, a teacher may find that he or she has not been exposed to this level of chemistry for many years and must spend long hours reviewing and relearning difficult concepts, particularly when the course is first introduced.

Teachers should be prepared to commit their weekends to learning new material and staying current with teaching strategies. They should also be ready to devote some time during the summer to attending College Board workshops and institutes. These are helpful for learning new teaching techniques and staying current with new concepts and revisions in the AP Chemistry course. College Board workshops not only help new AP teachers get started, they also provide a forum for an exchange of ideas and concerns between all teachers, experienced and novice, and the AP Chemistry Development Committee representatives. Information on workshops and summer institutes may be obtained by contacting the College Board office in your area. (Please see the inside front cover of this guide for a list of College Board regional offices.)

As compensation for their commitment, AP teachers, many of whom chose to be chemistry teachers in part because of a love for the subject, will find that they are able to teach at a much higher and richer level. Teaching AP Chemistry will allow them to work with the most talented and motivated students a school has to offer and communicate with them on a level they might not otherwise have had the opportunity to do. Discipline problems will be minimal, and the emphasis will truly be on instruction. Teachers of AP Chemistry will gain the respect of their colleagues, school administrators, and the community. Most people recognize the extra effort that is necessary to have a successful AP Program and hold in high regard those teachers who are involved in it. Professionally, AP Chemistry teachers can look forward to sharing with colleagues at conferences, workshops, and institutes and may find they are given release time for preparation. Most schools provide extra budget consideration to the AP Chemistry program.

Demands of AP Chemistry on Students and Their Parents

Students must be aware of and accept their role in the team effort. Some students may believe they are ready for college-level work without having any real comprehension of what that means. Some may think that, because they have not been challenged in their other courses, talk of an increased time commitment and workload is just another scare tactic that will not apply to them. All students who want to be successful in AP Chemistry must be prepared to work harder in this course than they have ever worked before.

Academically, students may find that, even with their additional effort, the rigor of the course puts their grade point average in jeopardy. Socially, students may feel isolated from the mainstream. While other students have a modest amount of outside work and plenty of time for outside activities, AP Chemistry students will find they have significantly more work, both inside and outside of class. As a result, they may find that they do not have time for the outside activities they have enjoyed in the past. Although an argument can be made that perhaps high school students should not be burdened with this level of responsibility, it can also be argued that many thrive under the challenge of the course. Those students who do choose to take the AP Chemistry course should recognize the course for what it is — rigorous and rewarding.

Parents of an AP Chemistry student must be prepared for a certain amount of disruption in their family life. They may find their son or daughter needs rides to school outside of normal school hours to make up labs or get extra help. They may have to postpone a family vacation planned for some time during the school year because it compromises their child's performance in the course. Parents may also notice that their child feels a certain amount of pressure and stress from the demands of the course. Although they may understand the reasons for this, it is never easy to watch a child struggle with schoolwork.

To compensate for the responsibilities that come with being in an AP class, successful students will find that at the end of the course they have a score that gives them credit and/or waives course requirements at most colleges and universities in the United States. For those who choose to apply to some of the more prestigious colleges and universities, a transcript that indicates successful work in AP Chemistry decidedly distinguishes a student. AP Chemistry is well recognized internationally for its academic rigor, development of higher-level thinking skills, and the kind of academic commitment and dedication required of college students.

Enrollment in AP Chemistry allows a teacher to know his or her students well. This is a tremendous advantage to students when it comes time to request a letter of recommendation for college admission. A teacher who is familiar with a student's problem-solving techniques, team-building skills, and ability to handle the demands of college-level work, can write from a more meaningful perspective. Finally, many top students have found that, although they have a love of science, their higher-level thinking skills have never really been challenged before. AP Chemistry stresses these skills, which will prove beneficial in later course work.

The benefits to parents are similar to those for students. In many cases, parents have a better perspective of the long-term benefits of taking an AP course because they know it gives their child a head start and an advantage in the competitive arena of college. They can see that learning difficult material early and in a small class setting is a preferable situation. Most parents view AP Chemistry as a wonderful opportunity and give their children their wholehearted support.