

## Chapter 1

# Knowing What You're Up Against: The AP Chemistry Exam

### *In This Chapter*

- ▶ Making sure the exam is right for you
- ▶ Breaking down the exam into all its parts
- ▶ Ticking through the topics covered on the exam
- ▶ Acing the questions
- ▶ Understanding your score

**1**ust the words “Advanced Placement” can bring about trembling fits of fear in even the best of Chemistry students. The good 'ol folks at the Educational Testing Service (ETS) — the company hired by the College Board to write and grade the AP exams — have been disseminating this fear for over 50 years, and they've had the time to get quite good at it. Consider this chapter your best bet at releasing your fear, getting some early college credit, and planning what to do with all the free time you'll have in college by not having to take an intro chemistry course.

As you get intimate with the AP test, you will become familiar with why you should (or shouldn't) take this test, the test's structure, how you will be scored, and how to plan your time effectively. In this chapter we uncover the often-overlooked strategies for taking the exam itself.



You already know a whole bunch about chemistry. After all, you've probably spent the best part of this year listening eagerly to your high school chemistry teacher (in between texting your friend and downloading the latest Modest Mouse tune). Of course, nothing takes the place of full comprehension of the material, but knowing chemistry is only part of the puzzle (albeit a really big part). We can show you some other things that you can do to help raise your score that have little to do with chemistry. So sit back, relax, and let us show you the way.

## *Seeing If You Have the Right Stuff*

Taking the AP exam sends out a beacon to the folks at any college that you believe you can think and perform on the college level, but can you? Although taking an AP chemistry course is not a prerequisite to taking the AP chemistry exam, we highly recommend that you do. Plus, you must be honest with yourself. If you received poor grades in chemistry in high school and could care less about stoichiometry, or if you accidentally blew up your high school chem lab by combining various chemicals, you might want to consider spending your time in an area you truly enjoy (perhaps a money-making vocation where you can pay for that lab to be rebuilt).

However, check out what your high score on the AP exam (see “Getting the Skinny on the Scoring,” later in this chapter) can get you:

- ✔ You prove to the college that you understand advanced material and already possess what it takes to be successful in college. Well, go you!
- ✔ You have the opportunity to receive credit or advanced standings at most universities around the country. In plain English, this means you can sleep in a bit, because you won’t have to take an intro chemistry class in college because you already proved that you know this stuff! Even better, if you aren’t planning on studying science in college, you probably won’t ever have to take another science class again! Yippee!



Those smart AP creators have AP tests in a variety of different subjects, so if you’re not sure about your dedication to this particular test, you might want to visit their Web site and glance at the other subjects they offer. If you’re just taking the AP chemistry class and don’t plan on taking the exam at the end, then that’s cool too. Skip this chapter and use the rest of the book for succeeding in the AP chemistry class.

## *Knowing the Breakdown — So You Don’t Have One!*

Considering that the AP folks don’t provide anti-anxiety salt licks as you walk into the exam, knowing the breakdown of the exam ahead of time prepares you for what you’re up against and makes you more confident so that you’re better relaxed to take the exam.

The AP Chemistry exam takes three hours and includes two sections; a 90-minute, 75-question, multiple-choice section and a 95-minute, 6-question, free-response section. We explain these sections further in the sections that follow.

## *Making your way through multiple-choice questions: Section 1*



You can’t use a calculator on the multiple-choice section. With the recent capabilities of graphing calculators, it could probably take the test for you! The AP higher-ups figured this one out a long time ago.

You have to answer (or try to answer) 75 questions on the multiple-choice section. Each question has five possible answer choices. We have a feeling that the AP creators couldn’t agree on what to put on the exam, so they just tossed everything into it. The questions you will encounter cover a large amount of material. Not all students will be exposed to all the material that the test may cover, so don’t be surprised to see topics that may be unfamiliar to you. You can expect basic factual questions as well as heavy-duty, thought-provoking problems, including 10 to 12 math problems to be done without a calculator. This section is worth 50 percent of your score.



You will only have about 1.2 minutes to answer each question. If you don’t know the immediate answer, skip the problem and move on.

## Taking on free-response questions: Section 2

The second section of the exam consists of free-response questions. You will find a total of six questions:

- ✓ Three quantitative problems (one on chemical equilibrium) lasting 55 minutes.
- ✓ One of the questions will be on chemical reactions, which will require you to write balanced net equations for chemical reactions.
- ✓ Reaction question and two essay questions lasting 40 minutes.
- ✓ One of the six questions will be a laboratory-based question that could be located in either the quantitative section or the essay section, so pay close attention when we cover labs throughout this book because the lab question could be on anything.

The free-response questions are long, make no bones about it. They will require you to demonstrate your problem-solving skills, show knowledge of chemical reactions, and question your ability to reason and explain ideas logically and clearly. They are broken down into multiple parts. Basically, the test will ask you multiple questions about the concept and require you to show concept mastery.



You won't be given an incomprehensible topic for any of the free-response questions. You will be asked to solve a fairly basic chemistry concept, but they will want you to go into detail and ask you several different questions about it. There will be formulas to use and numbers to work with. Although the free-response questions are long and daunting, they're not there to trick you. The multiple parts often help to lead you to the right way to tackle the problem. The AP people want to see your true chemistry acumen, and this is the best way to assess that. We will discuss how to tackle free-response problems later in this chapter.

You can use certain tools during this portion of the test. The following list shows you what you can bring in and what the AP folks provide, as well as the restrictions on these tools:

- ✓ **Calculators:** You can use your calculator for the first 55 minutes of the free-response section, but you can't share your calculator with another student. The AP folks also restrict which calculators you can use on the AP test. Because technology changes so rapidly, you should check the College Board Web site ([www.collegeboard.com](http://www.collegeboard.com)) for an up-to-the-minute list of acceptable calculators.
- ✓ **Tables containing commonly used equations:** You can use these tables only during the free-response section. You can't use them on the multiple-choice section. The free-response section requires you to solve in-depth problems and to write essays where the knowledge of the concepts and how to apply the principles are the most important parts of solving the problem. The College Board gives everybody the table of equations to make it fair for the students who may not have the equations stored in their calculators. The AP folks have some heart, after all! But remember, because the test gives you the equations, you will receive no credit for answers simply written down in equation form without supported explanations or some type of logical development.

## Tackling the Topics Covered

Before the AP exam was written, a few geeky chemists studied the chemistry curricula of many of the nation's best colleges. They combined their reports and came away with a clear idea of the stuff being taught to chemistry college students around the country. The end result culminated in the AP chemistry exam covering five key areas, and because we're

obsessive about making sure you're the most informed you can be (and because we're control freaks), we've outlined each area for you below:

- ✓ **Structure of matter** (20 percent of test; see Chapters 3 through 8):
  - **Atomic theory and atomic structure:** Evidence for the atomic theory; atomic masses; atomic number and mass numbers; electron energy levels; periodic relationships
  - **Chemical bonding:** Binding forces; molecular models, geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes
  - **Nuclear chemistry: nuclear equations, half-lives and radioactivity**
- ✓ **States of matter** (20 percent of test; see Chapters 9 through 12):
  - **Gases:** Laws of ideal gases; kinetic molecular theory
  - **Liquids and solids:** Liquids and solids from the kinetic-molecular viewpoint; phase diagrams of one component systems; changes of state, including critical points and triple points; structure of solids
  - **Solutions:** Types of solutions and factors affecting solubility; methods of expressing concentration; Raoult's law and colligative properties; nonideal behavior
- ✓ **Reactions** (35 to 40 percent of test; see Chapters 13 through 22):
  - **Reaction types:** Acid-base reactions; precipitation reactions; oxidation-reduction reactions
  - **Stoichiometry:** Ionic and molecular species present in chemical systems; balancing of equations including those for redox reactions; mass and volume relations
  - **Equilibrium:** Concept of dynamic equilibrium, physical and chemical; quantitative treatment
  - **Kinetics:** Concept of rate of reaction; use of experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws; effect of temperature change on rates; energy of activation; relationship between the rate-determining step and a mechanism
  - **Thermodynamics:** State functions; first law; second law; relationship of change in free energy to equilibrium constants and electrode potentials
- ✓ **Descriptive chemistry** (10 to 15 percent of test; see Chapters 23 to 27): Relationships in the periodic table (periodicity); chemical reactivity and products of chemical reactions; introduction to organic chemistry
- ✓ **Laboratory** (5 to 10 percent of test; see Chapters 27 and 28): Making observations of chemical reactions and substances; recording data; interpreting results; communicating the results

## *Understanding the AP Test Questions*

The AP chemistry test offers no surprises. Every question covers one or more basic fundamental chemistry concept, tests you on your knowledge of the five areas described in the section above, "Tackling the Topics Covered." Following the basic guidelines in this section helps you tackle the multiple-choice and free-response sections of the exam.

## *Making sense of multiple choice*

Of the two parts of this test, the multiple-choice part is easiest because the correct answer is staring you right in your face; you just need to find it. In the following sections, we describe the different setups of multiple-choice questions, and we've also included a section that shows you some educated-guessing techniques to help you whittle down the obvious wrong answers.

### *Clearing out the "crowded" questions*

Basically, there are three types of multiple-choice questions. The first type of questions you encounter we call "crowded together" questions. These are the easiest because they take very limited time to complete. With crowded together questions, you get some information upfront lettered A through E. After this information, you get two to three questions pertaining to the initial A through E information. You just pick the correct letter choice to solve the questions.

### *Standing out from the crowd: Dealing with "loner" questions*

Another type of question that makes up much of the multiple-choice questions we like to call "loner questions." Each loner question covers only one lonely topic at a time. You're presented with a question providing you with the information you need to complete the problem, usually five possible choices, again lettered A through E.

### *Putting a spin on interpretative questions*

The interpretation questions do not occur very often, but they're important to know about. Basically, the interpretation questions take two somewhat related loner questions and stuff them together and then ask you two or more questions about the information. You are given a graph, diagram, or data table, and are then asked two questions about the presented visual.

### *Getting through the questions . . . with as many right answers as possible*

The AP test creators throw everything at you at once, so don't think that the test starts easy and gets more difficult — it doesn't. Manage your time on the test using these tips:

- ✓ **Short questions:** Answer the questions that are the shortest first, leaving more time for you to put a little more time into the longer, more intense questions.
- ✓ **Easy questions:** Answer the questions that make you want to smile first (the concepts you know the most about), and leave the questions that make you want to vomit for last.
- ✓ **Educated guessing:** Educated guessing is a good thing. Eliminating even one possible answer increases your choices of hitting the right one. You don't get penalized for leaving an answer blank, but you do get a fraction ( $\frac{1}{4}$ ) removed from your score for a wrong answer. On the other hand, guessing correctly earns you a full point. In other words, completely random guessing neither hurts nor harms you. Educated guessing helps you. If you don't know how to solve the problem but want to make an educated guess, keep these ideas in mind to make the best possible educated guess:
  - Take a quick glance through the possible answers.
  - The AP folks are not trying to trick you, so if something looks blatantly wrong, it probably is. So you're probably safe to eliminate it.
  - Eliminate the answers that don't seem to match up to the question.
  - Eliminate answers that appear too close to the actual question.



## *Finagling the free-response questions*

The free-response section takes 95 minutes and has six questions divided into two parts:

- ✓ **Part A:** Part A takes 55 minutes, in which you answer three questions for which you're allowed to use your calculator. Part A covers one equilibrium problem and two other problems.
- ✓ **Part B:** Part B takes 40 minutes and covers the last three questions, one being a reactions question and the other two being essay questions. A lab question is thrown in the mix somewhere. Calculators are *not* permitted in Part B.

Part A counts for 60 percent of your score in the free-response section with each question counting 20 percent. Spending a little extra time in Part A is worth it.

### *The test giveth . . .*

Before you begin the free-response section, you are given a plethora of information:

- ✓ You will be bombarded with four, highly coveted pages of chemistry-related material, consisting of a whole bunch of equations and constants covering atomic structure, equilibrium, thermochemistry, liquids, gases, solutions, oxidation-reduction, and electrochemistry.
- ✓ You will also receive a limited periodic table and a reduction potential table.



Right now, you might be thinking, “Cool, I’ll be getting all the info I need to solve the problems.” But, when you get to the test site and look at the questions, you’ll soon realize that the good AP pros didn’t just give you *only* the info you need, but they also gave you a ton more than you’ll ever use on the test. So, even though you have information to take from, you still need to be chem smart to know when and where to use the info given to you.

### *Breathing easy by knowing what to expect*

On the free-response portion of the exam, you need to answer the questions in your own logical words and commit to your answers. The topics on the AP exam refer to general chemistry topics, so rest assured that the AP pros won’t toss some rarely taught concept your way to see if they can throw you a curve ball and screw up your game.

Most questions have multiple parts. You’ll first encounter some type of initial chemistry information (it could be a figure, a graph or a concept) and then see questions labeled a, b, c, and so on. Each of these subquestions requires you to write an answer of at least a sentence and sometimes a paragraph or two or to give a multistep equation as your answer.

You have approximately 18 minutes (three problems in 55 minutes) and 13 minutes (three problems in 40 minutes) to complete each free-response problem.

### *Putting partial answers into practice*

Don’t be stingy with your answers! Partial credit is given for saying at least *something* right in the answer. You receive points for writing certain correct portions of the answer, so take your time, write all you know, and do not rush. However, be sure what you write is relevant to the question. No points are given for writing about chemistry in general when the subject is sodium chloride.

If you come across a problem that freaks you out, remind yourself that there must be some part of the subquestion that you're more familiar with. Read the entire problem before starting it. Do not skip a problem simply because the vomit feeling is welling up inside of you. Take a deep breath, scan for any part of the question that you might be able to write about, and begin writing. You can still get a fairly high score even when you receive only partial credit for certain subquestions.

### *More tips directly from the source*

The College Board is nice enough to offer some tips of its own. In the following list, we offer you a condensed version of these tips to make your life easier:

- ✓ **Show all your work:** Partial credit is given for partial solutions.
- ✓ **If you do work that is incorrect, simply put an X through it:** Don't take the time to erase.
- ✓ **Organize your answers clearly:** If the scorers cannot follow your reasoning, they might not give you credit.
- ✓ **You do not need to simplify, but if you're asked to calculate, you must simplify all numerical expressions or carry out all numerical calculations to get credit.**
- ✓ **Do not use what they call a "scattershot" approach:** Avoid writing a whole bunch of equations or nonsense, hoping that that one among them will be correct.

## *Getting the Skinny on the Scoring*

While you wait patiently to find out if you're a genius, the secret scorers are busy at work squinting their eyes, rubbing their chins, and contemplating your entire chemistry future. You ultimately receive a score between 1 and 5. We know, after all the hard work you did, the hours of studying, and the sweating at the exam, the highest score you can receive is a measly 5! The nerve of those people!

While those AP pros might not be the most creative bunch of folk, they did do a lot of researching to figure out how to score you. They periodically compare the performance of AP students with that of college students tested on the same material. It comes down to this:

- ✓ **A score of 5** on the AP test is comparable to a college student's earning an A in his college-level chemistry course.
- ✓ **A score of 4** equates to B in a college course, and so on.
- ✓ **A score of 3 or higher** equates to a C in college and could still qualify you for college credit. Anything less than a 3 won't qualify you.

But the College Board likes the word "qualified" so here's how it puts it:

- 5 — Extremely well qualified
- 4 — Well qualified
- 3 — Qualified
- 2 — Possibly qualified
- 1 — No recommendation

## Scoping out the scoring process

You might be wondering how they come up with the 1 to 5 score. If you weren't wondering, well, we were, and we figured while we're at it that we might as well make the information available to you.

The multiple-choice section is scored by a computer. The answer sheets are scanned and the computer adds the number of correct responses and subtracts a fraction for each wrong answer. You don't get penalized for answers left blank, but you subtract a fraction from your score for each wrong answer. Thus, make only educated guesses (see the section, "Getting through the questions . . . with as many right answers as possible" for more on making educated guesses.)

The free-response section is scored by real, live people during the first half of June. Really, they're living, breathing people. Basically, major special college professors and veteran super-duper AP teachers come together in the summer and have an AP scoring party. They all gather, distribute their pocket protectors, and get down to the fun of reading your responses.

The scores from the multiple-choice section and free-response section are combined to give you a composite score.