

Science Safety

in the
Community
College

By John Summers, Juliana Texley, and Terry Kwan

NSTApress

NATIONAL SCIENCE TEACHERS ASSOCIATION

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C Contents

<i>Introduction</i>	vii
<i>SciLinks</i>	x

1	<i>Setting the Scene</i> Safer Science in a Drive-Through Learning Community	1
2	<i>Communities of Learners</i> Promoting Science for Every Citizen	15
3	<i>Where Science Happens</i> Equip Your Lab for Safety	29
4	<i>Finders Keepers</i> Essentials of Safer Storage	49
5	<i>Lively Science</i> Living Organisms and More.....	71
6	<i>Modern Alchemy</i> Safer Teaching With Chemistry	89
7	<i>Striking Gold</i> Exploring Earth and Space Sciences	105

8	<i>Falling for Science</i> Physics Phenoms	117
9	<i>The Great Outdoors</i> Field Studies Near and Far	129
10	<i>The Kitchen Sink</i> A Potpourri of Teaching Tips	151
11	<i>Live Long and Prosper</i> And Remember You Are Responsible	175
	<i>Conclusion</i> Review the Basics	183
	<i>References</i>	189
	<i>Web Resources</i>	190
	<i>Glossary</i>	199
	<i>Appendix A</i> Chemicals to Go—Candidates for Disposal	205
	<i>Appendix B</i> NSTA Position Statement on Safety.....	209
	<i>Index</i>	213

Introduction

Community colleges form the backbone of our nation’s system of higher education. More than 1,650 institutions across the nation serve a broad range of students, providing academic, social, career, and citizenship skills for a lifetime of learning.

Community college students are among the most diverse groups of learners in the country. They come from a wide variety of secondary institutions—or none at all, because GED (General Educational Development) diploma holders and home schoolers are as welcome as the local high school valedictorian. New Americans and grandparents sit next to precocious secondary students trying to get a jump on their college studies. Students ranging from those who have had the structured support of special education to those who have experienced no structure all meet in the community college classroom.

Engaging in real science isn’t just an academic ideal: It is essential to the understanding of evidence-based reasoning. But the diversity among students in an introductory community college science course makes creating a safe laboratory environment a tremendous challenge. When everyone is invited to participate without prerequisites, nothing can be assumed. The community college instructor can never rely on a common foundation of understanding or skills. This includes laboratory skills and safety precautions. Teach the basics. Do not assume prior knowledge and experience.

Challenging? Of course. But when we teach adults the skills they need to inquire about real-world scientific issues in a safe environment, they gain attitudes they will carry with them to their homes, their families, their workplaces, and their neighborhoods.

We believe that every adult in this nation should be scientifically literate and that we would have a stronger nation because of it. That means there’s no place where promoting scientific literacy is more important than in the introductory laboratory classes offered at a community college. We also believe that with background knowledge and good sense, every community college instructor, full time or adjunct, can implement a fully investigative laboratory science course in a safe learning environment. To do so requires planning and preparation, but it’s well worth the effort. So it is with great enthusiasm that we offer this guide to safety in the community college.

This book is one in a series of four that offer positive options, even as instructors learn more about hazards: *Exploring Safely* is the elementary school guide, *Inquiring Safely* is the middle school volume, and *Investigating Safely* is the high school guide. In *Science Safety in the Community College*, most of the guidelines for programs, coursework, and student behaviors have been formulated with the introductory student in mind. As students progress through a college sequence, they increase their knowledge

and skills, and the standard of best practice changes as well. We expect instructors will use their experience, training, and judgment to decide what might be reasonable for more advanced students. However, the guidelines for facilities—particularly those regarding space, safety equipment, and ventilation—should be considered standard for all course work, whatever the level.

Although the traditional safety manual is often a compilation of safety rules, regulations, and lists, this book takes another path. We offer a more narrative style, providing discussions of safety concepts in the context of commonplace situations in real classrooms. As we did in the first three volumes, we've included many anecdotes that highlight and reinforce ideas. We have changed names and made other modifications to better illustrate some hazards, but all of the stories are based on actual events. We hope this approach makes the book enjoyable to read as well as valuable to reference.

Because we recognize that another way to use the book is to look for specific topics, we have included a detailed index. You will find that some of the same information is repeated in several sections. This is to minimize flipping back and forth among chapters. A glossary at the end of the book defines terms as we use them and includes definitions of acronyms.

We hope the books are thought provoking. No single publication can cover every possibility or all the specific policies and rules promulgated by federal, state, and local authorities. Each state's community college system is different, and the buildings in which the programs are housed differ widely. Our goal is to provide you, the instructor, with examples of safer practices and to help you become more alert to ways of ensuring safety when you teach science in your laboratories and in field studies. Above all, we encourage you to use common sense and stay up-to-date with policies and regulations.

We believe that creating a safe environment for laboratory instruction in the sciences is a group endeavor, led by the instructor but joined by the entire institution. We have included information we hope you will share with department chairs, facilities directors, administrators, and others so they fully understand the support they must provide to enable you to conduct a safe and effective program. As you read, we hope this book helps you "see" your physical environment and your procedures through a safety-conscious lens. That will help you give your students habits of mind to last a lifetime.

No safety book can be omniscient. No guide can prescribe every action or precaution that might be needed in a college classroom. Safety is more than a set of rules: It's a state of mind. Because no single volume can anticipate everything that could go wrong, we believe instructors and administrators must make awareness of safety issues a skill and a habit. So we hope that as we share these experiences with you, you'll hone your own safety skills and that sixth sense that creates a stimulating and safe classroom for all students.

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Author Biographies

John Summers taught environmental sciences, biology, and chemistry for many years and continues to be involved in programs to support teaching and learning of the sciences at the precollege level. A presenter at numerous NSTA and American Association for the Advancement of Science (AAAS) conferences, he is also a faculty member for online teacher training at the undergraduate and graduate levels. He has served on panels to structure and review frameworks, assessments, and systemic initiatives in the state of Washington. His special interests include using science-oriented outdoor experiences to challenge and connect with at-risk students.

Juliana Texley has taught all the sciences, K to graduate school, for 30 years and spent 9 years as a school superintendent in Michigan. For 12 years she was editor of *The Science Teacher*, NSTA's journal for high school instructors, and served as an officer of the Association of Presidential Awardees in Science Teaching. She currently teaches college biology and technology and develops and teaches online courses for students and instructors.

Terry Kwan taught middle school science before becoming a science supervisor and teacher trainer. She is an independent contractor, collaborating with private and public institutions to develop science programs, train teachers, and design science facilities. She served 18 years as an elected school board member in Brookline, Massachusetts, and currently serves as a lay member of the National Institutes of Health Recombinant DNA Advisory Committee and a community representative to Institutional Biosafety Committees for the Harvard Medical School and the Dana-Farber Cancer Institute.



How can you and your students avoid searching hundreds of science websites to find the best information on a topic? SciLinks, created and maintained by the National Science Teachers Association (NSTA), has the answer.

In a SciLinked text, such as this one, you'll find a logo and keyword in the text near a concept your class is studying, a URL (www.scilinks.org), and a keyword code. Simply go to the SciLinks website—www.scilinks.org—type in the code, and receive an annotated listing of web pages that have been extensively reviewed by a team of science educators. SciLinks is your best source of pertinent, trustworthy internet links on subjects from astronomy to zoology.

Need more information? Take a tour—www.scilinks.org/tour.

Setting the Scene

Safer Science in a

Drive-Through Learning Community

More than 1,650 community colleges across the country provide convenient, close-to-home access to learning. But the convenience and broad appeal of community college courses also create challenges for the instructor. Many community college students are distracted by competing obligations—family, job, and other responsibilities may vie for time and attention. Because students don't have to pay high fees or move away from home, they may treat introductory courses like an academic smorgasbord. Some may come early, ready to enjoy a feast. Some may stop in to sample the menu, ready to drop a course at the first sign of challenge. Still others transfer in when a different course gets tough, hoping that a science course is more to their liking. The challenge is to keep every guest at the science banquet and enable each to develop a true appetite for science inquiry as a critical skill in comprehending the world. Along with the challenge, community college instructors may have a unique advantage. Unlike teachers of high school or four-year college students, community college instructors can count on a powerful characteristic in most of their students—motivation. Community college participation is almost always a voluntary act, motivated by the student's personal goals. It takes a special effort to drive to each class on time, prepared and ready to work. Though you may compete for their attention, your students want and need what you have to offer. You hold the keys to their future.

A Scientifically Literate Citizenry

The National Science Education Standards (NSES) (NRC 1996) leave no room for doubt—inquiry-based science is vital to producing scientifically literate adults. Although they were written primarily for K–12 programs, the critical thinking and analytic skills inherent in scientific literacy are as important to all adults as to professional scientists. The same skills and thought processes engendered by laboratory investigations are those your students will need in the workplace, in the home, and in the voting booth. This way of knowing is critical for successful citizens and to a functional society.

Even if you represent a student's one and only exposure to science, your role is vital. The introductory science course may be the last opportunity members of our increasingly diverse society have to learn how to gather, evaluate, and draw conclusions from empirical evidence. What they learn or do not learn can influence significantly the way they make decisions as citizens, employees, managers and leaders, parents, and voters.

Evaluating choices and accepting, rejecting, or modifying recommendations based on data occur regularly in adult life whether a student chooses a career in science and technology or not. An individual's ability to weigh options with scientific and logical rigor, to reject pseudo-science, or to accept scientific analyses may well be based on that person's experiences in the course you teach. Providing a program that demystifies science and puts it in a safe and understandable context may be even more important for students not planning to pursue careers in science and technology than for those who do.

Moving Up Safely

Developing a responsible and safe introductory community college laboratory science program is a challenge. The subject matter is complex, requiring cerebral, technical, and mechanical skills. The prior knowledge and experiences of students are diverse—they range from retired professionals returning for intellectual stimulation to high school dropouts who have discovered the need for education and just passed their General Educational Development exams.

For most instructors, what can be controlled is limited. The course outline, the prerequisite requirements for students, and the physical facilities often are prescribed institutionally or by groups of instructors. In larger community colleges, the responsibilities for parallel sections may be shared by full-time and adjunct instructors. They must share facilities, equipment, and supplies even though they rarely meet. Although community college students may receive information through course catalogs, they make decisions regarding registration and attendance with much less guidance, structure, and support than afforded to secondary students.

These circumstances make it all the more important that you, your colleagues, and administrators have structured guidance to ensure that laboratory investigations have been selected and designed with safe practice in mind and conducted in facilities that are appropriate. We hope this book provides some of that guidance and that, more important, it reminds all involved that specific attention must be paid to safety for all laboratory science instruction.

Using This Book

After you read this overview chapter, the way you use this book will depend upon your experience, your training, and your assignment. You'll find the book includes a

lot more than just a list of safety rules. There are tips for teaching, management, and even your own mental health. You may wish to skip right to your own discipline (in Chapters 5 through 8) or use the index to find best practice on a specific topic, such as Standard (Universal) Precautions, contact lenses, or internet safety. Or you may want to use the book as a refresher for your own professional development, reading it from start to finish.

If you choose the latter course, you'll find some repetition. Some ideas deserve to be repeated. Some appear more than once to accommodate those who read only a part of the book, including administrators, support staff, and disciplinary specialists. Other ideas may seem obvious to full-time veteran faculty but may surprise adjuncts who come to teaching from business or industry.

No matter how you choose to read this book, you are likely to find something that makes you uncomfortable—a treasured demonstration or customary practice that isn't considered safe. You're not alone. We've had the same experience in writing and working with instructors while developing the book. Change is never easy. You'll likely find some precautions that you just don't believe; your experience and training may have convinced you that they are not only safe but also essential to your goals as an instructor. That may be true and may be appropriate in your program. But it's also possible that thus far you've just been lucky. So we invite each of you, our peers, to consider seriously the precautions we've included and to use good judgment in adapting them to your assignment and your institution.

You're likely to find differences between this book and the traditional safety manual. Our recommendations are based not only on physical dangers but also on developmental and experiential appropriateness. In many cases, we don't discuss just *how* to make an investigation safe, but also *why* it should or should not be done at a given instructional level. This may be a new perspective for many veteran instructors, but we have found that laboratory accidents can frequently be traced to assuming that students bring knowledge or experiences that the instructor or former students have had, but which the current population has not had. In this day of butane lighters and piezoelectric sparkers, you may be quite surprised at how many students don't know the difference between a safety match and an ordinary friction match. You may be quite familiar with sterile technique, but your students may not have studied—or may have totally forgotten—germ theory.

Chapters in Brief

The low cost and convenience of community colleges are two factors that draw the diverse population who attend. Among the things students are looking for at a community college are a slow transition to college work, remediation, and “cover” to stay at home or in the country. What is almost always a common factor is the proximity of the college to the students' residence or workplace. Unlike high school classes, which are frequently leveled by interest and ability, or four-year college and graduate courses

in which students are sorted by majors and prerequisites, the community college class is likely to have students with a plethora of interests, prior experiences, and goals. In Chapter 2, “Communities of Learners,” we look at ways to accommodate diverse needs and goals—not only to make your program safer but also to help everyone involved achieve the goals that brought them to the community college campus.

Many of our college buildings are aging. In some institutions, increases in enrollment have forced administrators to use stopgap scheduling or emergency housing. National studies have found a significant increase in the number of buildings in serious need of repair, while shortfalls in state budgets have left publicly supported colleges with few extra dollars for renovation or expansion. Facilities are vital to safe science, as you will see in Chapter 3, “Where Science Happens,” which discusses space and equipment, and Chapter 4, “Finders Keepers,” which discusses storage.

Meanwhile, the body of content knowledge in each discipline of science constantly changes. What was yesterday’s best practice can be today’s unacceptable risk. Chapters 5 through 8 summarize many of the most common cautions in the science disciplines for instructors in life, Earth, and physical science classrooms. In Chapter 9, we’ve included tips for field studies and exploring “The Great Outdoors.”

The 21st century has brought new technology as well as new concerns. After covering traditional safety categories, we added Chapter 10, “The Kitchen Sink,” which discusses items that fit nowhere else, such as internet use, allergies, and Standard (Universal) Precautions.

Today’s society is quite litigious, and many people place blame on instructors for factors well beyond the instructors’ control. So finally, in Chapter 11, we share tips on how professionals can “Live Long and Prosper” by protecting themselves as well as their students.

Keeping Up

What do those degrees on your wall mean? A prescribed sequence of courses? A statement of competency? A ticket to a job? Since your last formal course work, a great deal could have changed, both in your science discipline and in teaching techniques. An important step to safer college science is to keep on learning.

It’s not just the content of science that changes but also the standards for safe investigation. To structure a safe college science program, you must stay current with both research findings and regulations. Which chemicals now require special handling or are banned outright? What cultures and culturing practices previously thought harmless are associated with serious infectious disease? What are the latest requirements for protective gear? Best practice is constantly changing. You must remain up-to-date and so must your course outlines. That’s especially challenging for a faculty that is partly or predominantly adjunct.

Students change too. Their interests and developmental levels are affected by previous school experiences and by their experiences outside school. Demonstrations once considered motivational—such as explosions—are now considered dangerously tempting to students who have been bombarded by media violence. It's not enough to simply evaluate the content of an inquiry; you must also consider the context in which today's students will receive it.

The information that qualified you for your degree and the course outlines and lab assignments you first used may quickly become outdated. You can't depend even on a book like this one for your entire safety knowledge base. Each disciplinary expert should assume responsibility for keeping up-to-date in his or her area. To help you do that, internet links and references accompany each chapter. We've also included information that leads you to online course work and mentoring by professional associations. We hope you'll join us as lifelong learners in the important endeavor of ensuring safety in science investigations.

It May Take a Village

Some battles have to be fought by the department rather than by individual instructors. For instance, although science instructors may be knowledgeable in multiple science disciplines, it's usually unwise to assign someone to instruct in more than two distinctly different laboratory courses in any single term. The challenge of keeping up with rapidly changing standards and best practice is just too great.

Late registration is another issue. Instructors often begin the semester with a course overview and a review of basic safety procedures. The first lecture session is the opportunity to make sure students understand the syllabus, and the first laboratory session usually is used to introduce students to laboratory facilities and general expectations for lab work. If a student registers late and shows up after these presentations, you are still responsible for ensuring the student receives the same introductory instruction—especially as it relates to safe laboratory practice.

It may be hard to convince college registrars to turn down the prospective revenue of a late registrant. But it is essential that everyone understand and work to mitigate the risks. It may be that the department needs to create a separate laboratory introduction session or exercise that must be successfully completed by all students. This might be incorporated in a web-based tutorial on an online learning platform, such as Blackboard or WebCT, that can record and document successful completion by each individual. It must be thorough, and documentation of successful completion must be non-negotiable.

Safe, well-organized, clean laboratory space is also a condition that can be achieved only if all instructors participate. Community college laboratories are likely shared by multiple instructors and often have no individual clearly responsible. Safety equipment

SAFETY IN THE SYLLABUS

Consider where these key ideas might be built into your course syllabus:

- ▶ Clearly describe your goals and expectations. Specify not only content, but also laboratory skills, practices, attitudes, and conduct.
- ▶ Make students responsible for regular on-time attendance and for making up all instruction missed because of lateness or absence.
- ▶ Establish that students who miss preparatory and safety instructions will not be permitted to participate in laboratory work until all preparatory and safety work is made up.
- ▶ Identify all the ways you will be offering safety and lab practice guidelines: orally, in writing, on a web learning platform, or some other format.
- ▶ Provide specific options for students with disabilities, those with limited English proficiency, and those with limited access to technology.
- ▶ Include specific steps you will take to measure student understanding of safety issues and laboratory practices prior to activities where such knowledge is necessary. Do not depend solely on distribution of handouts and head nods to indicate understanding of critical safety issues, especially for students with disabilities or limited English proficiency.
- ▶ Insist on students' presence from beginning to end. Make it clear that critical instruction will begin at the start of class, and that latecomers may be excluded.
- ▶ Set standards for how quickly—or slowly—you expect work to be done. Avoid using a system where students can race through a laboratory exercise and leave early. This rewards speed and often engenders carelessness.
- ▶ Clarify how a student can make up laboratory work—if at all.
- ▶ Incorporate a rubric for safety, cleanliness, and organization in the grading scale.
- ▶ Affirm that each student is responsible for being an active participant in the education process and ensuring safe, appropriate laboratory practices at all times.

may be missing, outdated, or untested; hazardous materials may accumulate; and valuable or potentially dangerous equipment or materials may be left unsecured. Common expectations are needed so that instructors who may never meet each other can expect that certain minimal standards are applied.

You *can* fight city hall—or the dean’s office—if you act collectively. It’s easiest if everyone is on the same team. If your department head or administration is unaware of ever-changing regulations, safety risks associated with late enrollees, minimal standards for laboratory facilities and equipment, and the need for regular, licensed hazardous waste removal, you may need to tell them. If all else fails, share some of the guidance and legal precedents that we’ve included in this book.

Planning for the Safe Classroom

The paragraph describing a course in the college guide is usually written by committee. This is not always true for advanced courses, but it’s important that all students in a college get the same basic knowledge and skills in their introductory science experiences. That means that an individual instructor may not have much influence on the profile of a specific course. But what if the activities that a committee—or your predecessor—has chosen don’t seem safe? No matter what the history or how great the institutional pressure, it is important to remember that the students and sequence assigned under your name are your responsibility. In case of an accident, saying “It was always done that way” just won’t fly.

Because each member of a department may have a unique schedule and because meeting time may be scarce, many schools have established online discussion forums for their faculty. These opportunities for almost real-time shoptalk are invaluable. Even if you are assigned only one course on an occasional basis, make sure you participate all year long. Your input—and the choices you make—may depend upon every member of the faculty having the same current knowledge of risks and responsibilities.

The Syllabus Is the Thing

Many schools make syllabus preparation easy by offering templates so they can be quickly prepared. You may be provided with older course outlines that have been used for decades and be tempted to merely tweak the details. Or, you may be given a course syllabus prepared more recently by someone else. In today’s litigious society, we strongly recommend that you consider the syllabus you hand out to your students as a written contract between you and your students and that you incorporate language that clearly sets out your expectations and student responsibilities—even if that means providing an addendum to the existing document. Think of the syllabus as written evidence that you have provided a well-thought-out description for the conduct of the course and the conduct of your students.

Dampening the Swinging Door

A problem for some community college students is consistent and on-time attendance.

Emphasize your expectations for consistent attendance in a number of ways:

- ▶ Begin classes with a short activity that requires a specific product or outcome. Assign a small percentage of the course grade for these activities. (This is a great way to review safety.)
- ▶ Provide examples of appropriate and inappropriate reasons for absence. While you should be supportive of major life events, emphasize your high expectations for regular class attendance.
- ▶ Make it clear in the syllabus that failure to be present for the safety instructions will result in exclusion from the laboratories.
- ▶ Set firm rules for cell phone use. Under ordinary circumstances, cell phones should be turned off before a student enters the lab. For the rare instance when there must be instant contact with a student, silent paging should be in use.
- ▶ Assign responsibility and credit for group interaction. Make members of a group responsible for instructing and reinforcing procedures to all members.

The Best-Laid Plans

You will lower your stress and your liability, whether you are an experienced full-time instructor or an adjunct, if you establish the discipline of preparing complete and detailed written plans. As you'll see in Chapter 11, these plans not only create peace of mind but also provide valuable documentation in case a problem occurs. But recognize that detailed lesson plans can look great on paper and fall short in practice. The best format is one that is convenient for you to prepare and easy for you to follow. You may want to make columns in a plan book to list materials to prepare, time requirements, chemical allocations, and safety reminders.

An important planning principle is that old lesson plans should not be reused without examination and evaluation. Even with revisions, do not keep a plan beyond a set time—say, two or three years. When that time has elapsed, develop something new to ensure that your material is current and your teaching is fresh and enthusiastic.

Make Every Minute Count

If you've had a strong background in teaching strategies, you may be familiar with the research on how the brain stores information. If you've come to education from research or industry, this may surprise you—students don't concentrate much longer in minutes than their age in years, and that linear progression levels off at the age of 20. College students' attention, regardless of age, begins to wander if you try to talk for more than 20 minutes without a break or change in activity.

Using 20-minute elements is key to planning a college science block—especially for courses that meet for several hours once or twice a week. Attention span is also a factor to consider in safety instruction. Plan your sessions as a series of short, varying activities that each last no more than 20 minutes. Combine didactic instruction with debate and discussions, large-group instruction with study group or laboratory group work, safety instruction

with actual use of equipment. This approach will make your class more interesting, more effective, and safer.

You'll find some specific ideas for session elements in this book in sections called "The Savvy Science Instructor" at the end of each chapter. You can find many more ideas in the National Science Teacher Association's (NSTA) journals available online at www.nsta.org.

Never Assume

Some students walk into your classroom with cell phones and iPods but have never seen or used a manual can opener or tuned a radio without a scan button. Others may bring years of life experience to their college science course but seek a quiet corner in the back of the room, intimidated by the energy of the younger students and hesitant to apply highly developed life skills in the academic environment. Learning-disabled students, often supported by special education programs through most of their prior education, may be working without this support for the first time. English language learner (ELL) students may nod frequently, leading you to believe they understand all of your instructions, but those nods may reflect their respect for your position or their desire to be cooperative rather than true comprehension. The first safety guideline for instructors in an intro course is "never assume." Special steps may be necessary to ensure everyone has really grasped the critical information you are trying to convey.

As you introduce your students to college science, try to see your program through the widely differing experiences—or lack of experience—of all your students. Think of your laboratory facility as an entirely new venue and laboratory investigation as an entirely new experience. Do not assume that a student has experienced previously any skill or procedure—not even how to safely handle matches.

LABORATORY ASSISTANTS

One of the luxuries of most colleges is the help that instructors get from paid or credited laboratory assistants. Most lab assistants are supervised by a coordinator and specially trained in safety. Their access to chemicals and other potentially dangerous supplies is often controlled by strict institutional policies.

But no matter how well trained your laboratory assistant and no matter how well supervised, the ultimate responsibility for safety in your laboratory rests with you, your actions, and your instructions. There are many tips

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for lab management in the chapters that follow. But in general, when you work with laboratory assistants:

- ▶ Know and test your laboratory activities thoroughly. Make sure you have tried every part of every lab in advance and are aware of necessary precautions.
- ▶ Check all institution, local, state, and federal regulations that might apply.
- ▶ Ensure that you and your laboratory assistants model appropriate safety precautions, including use of eye protection and other safety gear.
- ▶ If your assistant has the authority to decant and dispense individual quantities of chemicals for labs, check out the chemicals that have been dispensed. Make sure that all reagents are fully and correctly labeled, that quantities are appropriate and correct, and that all stock bottles have been correctly re-secured.
- ▶ Personally check and test all equipment you will be using or needing (including all safety equipment) before the laboratory activity begins.
- ▶ Ensure that you have the MSDS (see Chapter 4 for MSDS details) on hand for all materials to be used.

Mix or Match: Safety Is Still a Must

In some college programs, each lecture (or content) section is matched with a required laboratory component. In others, the laboratories are sequenced independent of the lectures. When the two sections are matched and taught by the same instructor, there are many opportunities to reinforce key ideas and to build the rapport that supports responsible conduct.

When labs are scheduled as independent units, the basic rule of “never assume” becomes even more important. Students who come into these sections may seem knowledgeable but lack important concepts that would enable them to recognize and avoid dangers. The independent laboratory almost always needs its own built-in series of direct instruction sessions to make sure everyone is thoroughly informed.

The Teachable Moment

Instructors commonly begin laboratory science courses with a tour of the facilities to familiarize students with the location and function of safety and emergency equipment such as fire extinguishers, the safety shower, the fume hood, and the eyewash, followed

by a review of general safety rules, such as when protective equipment must be used. They often then give a safety test and keep the results as a record of the session. There's nothing wrong with this practice, but it may be insufficient to ensure safe practice by students. Safety instruction that is abstract and isolated from the activities to which the instruction applies is easily forgotten and will need reinforcement.

You should present general safety procedures—such as using eye protection, decontamination, and hand washing—at the beginning of the course. You also should repeat specific safety instruction in conjunction with the lesson or activity for which the safety procedure is needed. Even if you have reviewed the procedure a number of times, go over it *again* each time your planned activity requires the precaution. Keep a dated record of the specific instruction given to students who were absent or who later transferred into your course. Ensure that every student has received introductory safety lessons as well as the safety instructions associated with each investigation, and document the fact in a plan book or calendar.

Say It Again, Sam

With a revolving door on their lab courses and a diverse student body, community college instructors must be especially vigilant that each student has received all necessary safety instruction. Providing students with a written version of your instructions and safety directions and repeating them at the beginning of each relevant activity is important. When students are absent, they may miss safety directions. Keep an explicit record of what safety instruction has been given, when, and to which students. Keep this checklist as evidence that you gave proper and appropriate safety information to each student. Some instructors prepare and maintain a spreadsheet identifying students and safety issues. When a safety item has been presented, the appropriate square can be dated, providing a dated record of each student's safety preparation.

Some community colleges have open-enrollment policies that permit enrollment by students with only minimal English fluency. Depending upon institutional policy and your own good judgment, you may also need to offer safety instructions in other languages. Instructions may have to be tailored to students with specific learning challenges. You will also need to include appropriate methods of assessing comprehension. For more on this issue, see Chapter 2.

Out-of-Class Assignments

You are responsible and can be held liable for your out-of-class assignments. This includes independent study work and projects. Consider assignments carefully to avoid placing students in hazardous situations. Long work hours and family responsibilities may force students to squeeze homework into spare moments in random places, so consider your students' schedules and other obligations when assigning homework.

Try to structure assignments that have practical application and that can incorporate students' work, home, and other everyday experiences. For example, when instructing in microbiology, ask students to relate concepts to regulations and practices at their food-handling jobs or to propose appropriate hygiene practices in changing diapers. In chemistry classes, have students relate chemical characteristics with home or workplace chemical handling and hazardous waste practices. When introducing the concepts of variables and controls, ask students to apply these concepts to news reports regarding drug safety and FDA recommendations.

A Reputation for Excellence— Instructor as Model

Your classroom should be a professional place where everyone is expected to work seriously and dress appropriately. This is both for safety and for career preparation.

Model appropriate dress in your own attire—nothing baggy, torn, or hanging. Lab coats may be part of the caricature of the mad scientist, but they are also part of safe science, especially when you might be working with biological materials, stains, or toxins. Always use the appropriate eye protection during your own demonstrations and whenever you require your students to wear eye protection.

No food or drink in the lab applies to instructors as well as students—and no coffee or snacks, even in the back room if that back room is used for preps. Chemical and specimen-storage refrigerators must have prominent signage indicating “no edible food storage” and must never be used for lunches or other items meant to be eaten.

The physical environment also can contribute to or distract from the quality of instruction. Classroom clutter that cannot be distinguished from a midden both detracts from the seriousness of your endeavor and poses unnecessary safety hazards—fire, tripping, and undetected theft of valuable or hazardous materials.

Set High Expectations

As any veteran instructor knows, high achievement is the reward for setting high expectations for students. This is as true for safety as for any other expectation. The more you make students responsible for using and enforcing safe laboratory and fieldwork procedures, the more easily safe practice can become habit.

College science offers a rich curricular framework within which to build a safe environment for investigation. Safe work habits developed in the college laboratory should engender safe practices used at home and at work. With help from peers, friends, and the wider scientific community, the future begins here.

THE SAVVY SCIENCE INSTRUCTOR

Your students may appear to be more sophisticated and mature than they actually are. Mr. H emphasizes simple, small-scale, and authentic experiences and never misses the opportunity to show his freshmen the application of science to everyday experiences. He directs his students' attention to phenomena they might never admit they don't understand:

- ▶ Boiling point? Challenge students to heat pure water in an open container to above 100°C. Many believe they can.
- ▶ Sublimation? Observe snow piles disappearing without creating a flood.
- ▶ Water pressure? Explain how a toilet works.
- ▶ Biochemistry? Find DNA oozing out of bananas and onions.
- ▶ Radioactivity? Start with smoke detectors in homes and radon in basements.

For Mr. H's students, the world just becomes curiouiser and curiouiser.

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Index

Note: Page numbers in *italic type* refer to information in sidebars or tables.

A

Absenteeism. *See* Attendance
Acetyl salicylic acid 100
Acids
 concentrated inorganic 206
 picric acid 61, 207
 prediluted 106
 storage for 106
ADA. *See* Americans With Disabilities Act of 1990
Administration. *See* College administration
Air quality. *See* Ventilation
Air tools 108
Alcohol 42–43
Alcohol burners 43, 96, 108
Allergens 26, 72, 153
 latex 72, 158, 202
 molds 140
 nuts 159–160
 peanuts 72, 160
 plant irritants 140–141
 pollen 140
Allergies
 to insect bites or stings 140, 158–159
 low-level chemical exposure and 60
 odors and 100
 signs of sensitivity 72, 153
American National Standards Institute (ANSI) 163, 199
Americans With Disabilities Act of 1990 (ADA) 18–19, 78, 199
Ammonium dichromate 206
Amphibians 73, 77–78
Animals
 care levels 73
 exotic species 79–80, 200
 field study encounters with 139–140

 injured or sick 79, 139
 marine microcosms 139
 potential safety problems 73
 for research use 79
 roadkill 79, 80, 84
 wild 79 80
 See also specific types of animals
ANSI. *See* American National Standards Institute
Aprons 97
Aquariums 73, 77
Asbestos 34, 95, 110, 154
Astronomy. *See* Space science
Attendance 25
 how to emphasize the importance of 8
Attention deficit/hyperactivity disorder (ADHD) 18, 26
Autoclaves 43 75

B

Backcountry fieldwork 141–145
 accidents during 143
 campfires 141
 camping skills 143
 cell phone use 143, 148
 clothing for 141, 145, 146–147
 communications 147–148
 emergencies during 144–145, 149–150
 equipment and supplies 145–146, 148
 first aid 147
 food for 144
 footwear for 136, 142, 147
 glaciers 113
 headcounts importance of frequent 148
 infection from insects 140

 keeping focused on field studies 143
 permits for 143
 physical education faculty and 146
 physical fitness of students 129, 142, 146, 149–150
 poisonous plants 140
 sanitation 144
 students as stakeholders 132–133, 143
 trash removal 144, 148, 149
 twisted ankles 142, 143
 walking as a group 136, 142
 weather conditions 145
 See also Field trips
Bacteria
 cultures 111
 disposal 111
 lab activities involving 74–75
 non-native species 80, 202
 pathogenic 111
 Serratia marcescens 75
Balances 54, 94, 125
Ball bearings 127
Balloons 158
Batteries 120
Benedict's solution 85, 206
Benzene 85
Best practices. *See* Safety practices
Beverages in laboratories 12, 41, 95, 156, 159
Binoculars 110
Biological wastes 64
Biology 71, 185, 194–195
 animal research 79
 dissection activities 83–84
 field studies 109
 laboratory housekeeping 82
 live organisms 72, 73
 microbiology safety

Index

- practices 74–75
 - PTC tasting 86
 - soil samples 110–111
 - students as subjects 64, 80–82
 - Birds 73, 78
 - Black lights 126
 - Blood. *See* Body fluids
 - Blood–typing studies 64, 81
 - BOCA. *See* Building Officials and Code Administrators International
 - Body fluids 80–81, 156, 201
 - handling of 64
 - in laboratory activities 64, 80, 157
 - spill kits 81
 - Standard (Universal)
 - Precautions 25, 64, 80, 156–157, 156
 - testing of 64
 - Bones 64–65
 - Boric acid 100
 - Building Officials and Code Administrators International (BOCA) 163, 199
 - Buildings 4, 45–46, 153
 - ADA requirements 18, 21, 22
 - floors 22, 34, 153–154
 - hazardous materials remaining in 34
 - issuing ultimatums on safety 47
 - maintenance requests 46
 - renovation projects 46–47, 68–69
 - safety problems 46
 - See also* College administration; Laboratory design
 - Bunsen burners 95–96, 108
- C**
- Calcium carbide 206
 - Calcium chloride 100
 - Calorimeters 95
 - Capacitors 126
 - Carbon dioxide pellets 125
 - Carbon tetrachloride 85, 206
 - Carpentry tools 124
 - Carpets 34, 153–154
 - Cell phones
 - on field trips 143, 148
 - rules for classroom use 8, 66, 164
 - See also* Telephones
 - Chemicals
 - acids 59, 60, 108
 - allergic reactions to 60
 - biological 83, 84–86
 - biological stains 82, 84–85, 85, 206
 - chlorine bleach MSDS 57–59
 - cleaning products 155–156
 - in containers 63, 93
 - cyanoacrylic glue 108, 200
 - dilution of 86, 108
 - disinfectants 82
 - disposal of 61–63, 61, 62, 205, 206–207
 - donations of 62, 67
 - ethers 61, 85
 - for fieldwork 113
 - flammable 43, 59, 85, 92, 200
 - guidelines for handling toxic 107
 - harmless environmental damage from 62
 - hazardous list of 206–207
 - heavy metals 85
 - incompatible 93
 - labels on 45, 54, 102
 - lacquers 108
 - loaning to other schools 98
 - material safety data sheets (MSDSs) 33, 56–57, 57–59, 63, 108, 165, 185, 202
 - mineral specimens toxic 110
 - outdated 61, 67–68, 92–93
 - pesticides 82
 - powdered reagents 61
 - pregnancy and 169
 - providing other schools with 98
 - purchasing 86
 - reactive 59, 60, 93
 - specimen preservatives 83, 86
 - spills reducing risk of 93–94
 - tasting of 86, 110, 159
 - toxic guidelines for handling 107
 - toxicity 98–99, 100
 - See also* Laboratory equipment; Storage of chemicals; *names of specific chemicals*
 - Chemistry 89, 102, 185–186
 - explosive demonstrations 90–91
 - microscale experiments 61, 91–92
 - motivating students 91
 - students' backgrounds in 89–90
 - Chlordane 206
 - Chloroform 85, 206
 - Classrooms 177
 - access before scheduled class time 65
 - clutter in 12
 - for earth sciences 105–106
 - floors 22
 - laboratory equipment in 31
 - moving to another workspace 35
 - for science 203
 - shared 5–7, 32–33, 65–66
 - storage areas in 54–55
 - See also* Laboratories
 - Cleanup procedures 82, 155–156
 - Clothing
 - combustible fabrics 160
 - dress codes legality of 160
 - of faculty 160
 - on field trips 136, 141, 145, 146–147
 - footwear 136, 142, 147, 160
 - laboratory dress rules 96, 98, 123, 160
 - storage during classes 30, 66, 94, 106, 160
 - Cobalt 110
 - Colchicine 85, 206
 - College administration
 - liability of 21, 31
 - maintenance staff 66, 83, 163–164

- resources for disabled students 19, 26–27
 safety problem–solving with 67
- Color blindness 159
- Community colleges
 buildings 4
 disabilities services director 19
 student heterogeneity 2, 3–4
- Computers 121
 CD–ROMs 165–166
 documents in PDF format 165, 203
 flash drives 165–166
 monitors (CRTs) 125
See also Internet
- Conjunctivitis 162, 200
- Contact lenses 161
- Crisis prevention 168–169
- Crustaceans 73
- Cupric sulfate 100
- Custodians. *See* Maintenance staff
- D**
- Diethyl ether 206
- Disability coordinators 19, 26–27
- Disabled students 9, 177, 183–184
 administrative resources 19, 26–27
 alternative equipment for 17, 20
 attention deficit/hyperactivity disorder (ADHD) 18, 26
 color blindness 159
 communication disorders 18
 course materials for 17
 disruptive behavior by 137
 field studies and 129–130, 137
 hearing loss 22–23
 hearing losses 22–23
 online help for 27
 physical facilities and 78, 21
 requests for services 18–19
- resources for disabled students 19, 26–27
 safety problem–solving with 67
- Color blindness 159
- Community colleges
 buildings 4
 disabilities services director 19
 student heterogeneity 2, 3–4
- Computers 121
 CD–ROMs 165–166
 documents in PDF format 165, 203
 flash drives 165–166
 monitors (CRTs) 125
See also Internet
- Conjunctivitis 162, 200
- Contact lenses 161
- Crisis prevention 168–169
- Crustaceans 73
- Cupric sulfate 100
- Custodians. *See* Maintenance staff
- D**
- Diethyl ether 206
- Disability coordinators 19, 26–27
- Disabled students 9, 177, 183–184
 administrative resources 19, 26–27
 alternative equipment for 17, 20
 attention deficit/hyperactivity disorder (ADHD) 18, 26
 color blindness 159
 communication disorders 18
 course materials for 17
 disruptive behavior by 137
 field studies and 129–130, 137
 hearing loss 22–23
 hearing losses 22–23
 online help for 27
 physical facilities and 78, 21
 requests for services 18–19
- sound amplification for 22, 23
 state regulations concerning 19
 visually impaired 18, 22
 vocational plan requirements 19–20
 wheelchair accommodations 18, 21–22
See also Students
- Diseases body fluids and 64
- Disposal. *See* Hazardous wastes; Waste disposal
- Documentation
 of disruptive student behavior 133, 137
 field trip preparation 133
 of safety instruction 11
 of voice mail messages 164
 what to keep updated 180
- E**
- Earth sciences 186
 bioprospecting for microbes 111
 as elective courses 105
 field equipment 109
 laboratory equipment 107–109
 rock and mineral collections 109–110
 room requirements 105–106
 satellite imagery 115
 soil samples 110–111
See also Field trips
- Electricity 39–40, 95, 119–121, 184
 appliance repair inventory 120–121
 batteries 120
 extension cords 40, 119, 120
 generators 126
 GFCI protection 39, 95, 106, 119, 124, 201
 receptacles 119, 119
 repairs 120–121
 safety practices 122
 transformers 126
 variable power devices 126
- voltage 119, 126
- English language fluency
 of instructors 24
 safety instruction and 25
 of students 9, 11, 17, 23–24
- Environmental damage
 from disposal of harmless chemicals 62
 from non–native species 79–80, 202–203
- Environmental science. *See* Biology; Earth sciences; Space sciences
- EPA. *See* U.S. Environmental Protection Agency
- Ethanol nondenatured 85
- Ethidium bromide 85
- Eye protection 106, 107, 119
 against laser beams 126
 conjunctivitis and 162, 200
 contact lenses and 161
 contaminated eyewear 82, 106
 disinfecting eyewear 161, 162
 impact–resistant goggles 161, 201
 instrument eyepiece contamination 82, 109, 162
 for observing the Sun 112
 pinhole–reflection Sun observation 112
 safety eyewear 203
 safety goggles 203
 splash goggles 161, 161, 204
 standards for goggles 107, 161, 199, 201
 student ownership of safety goggles 161
 sunglasses 112, 141
 when using sharp instruments 95
- Eyewashes 34, 36, 162, 199
- Eyewashing technique 36
- F**
- Face shields 97
- Faculty
 accidents when working alone 54

Index

- guest experts on field trips 131, 135
- guest instructors 177
- individual storage areas for 53, 66
- itinerant instructors 65–66
- keeping up to date 175–176
- laboratory dress rules and 12, 160
- legal responsibilities 177–179
- liability not transferable to administrators 31
- online discussion forums for 7
 - as role models 12
 - safety ultimatums 47
 - as science fair judges 167–168
 - supervision of laboratory assistants 9–10
 - turnover in 53
- Family Educational Rights and Privacy Act (FERPA) 169, 200
- Field trip assistants
 - guest experts 131, 135
 - instructor–student ratios 136–137
 - laboratory assistants as 135
 - physical education faculty 146
 - untrained participants 135
 - when hiking 142
- Field trip travel
 - citizenship restrictions 134
 - distractions during 143
 - to foreign countries 134, 134
 - overnight excursions 134, 134
 - by private vehicles 136
 - telephone chain for
 - unexpected changes 132
 - transportation 135–136
 - travel planners' assistance with 134
 - walking as a group 136, 142
- Field trips 129, 186–187
 - animal habitats and 139–140
 - behavioral expectations 132–133
 - buddy system
 - recommended for 132
 - campfires during 141
 - on campus 130
 - chemicals on 113, 139
 - chronically disruptive students and 133, 137
 - clothing for 136, 141, 145, 146–147
 - consequences of
 - misbehavior 133
 - data collection 148–149
 - disabled students and 129–130
 - electronic probes 113
 - emergency medical treatment permissions 134
 - environmental permits 131
 - equipment for 109
 - first aid 147
 - footwear for 136, 142, 147
 - to glaciers 113
 - handwashing gels 111, 156
 - at indoor science centers 137
 - infection from insects 140
 - liability waivers 132
 - local suggestions for 130
 - marine microcosms 139
 - missing persons 131
 - monitoring student activities 131
 - parental permission for 131–132, 133, 134
 - physical fitness for 129, 142
 - for physics classes 123
 - preliminary site assessment 113, 115, 131, 138, 138
 - preparation documentation 133
 - protective gear for 109, 113
 - schedules written 132
 - site permissions and permits 131, 138
 - specimen collection 148–149
 - structure needed 132
 - students as stakeholders in 132–133, 143
 - students' medical records
 - needed for 131–132
 - tidal changes during 139, 145
 - water studies 114, 132, 138–139
 - See also* Backcountry fieldwork
- Fire escape routes 30, 43
- Fire extinguishers 43–44, 44
- Fire hazards
 - alcohol burners 42–43, 96, 108
 - combustible clothes 160
 - flammable chemicals 43, 59, 85, 92, 200
 - from heat sources 42–43, 96, 108
- Fire protection 43–44
- First aid 147, 158–159
 - bleeding 156
 - emergency showers 37
 - EpiPens for anaphylactic shock 140, 158–159
 - eyewashing 34, 36
 - on field trips 147
 - moving injured people 35
 - student training 35, 36
- Fish 73, 77, 86–87
- Flammable substances. *See* Fire hazards
- Food
 - for backcountry field trips 144
 - in laboratories 12, 41, 95, 159
- Footwear 136, 142, 147, 160
- Formaldehyde 86, 100
- Formalin 86, 207
- Fume hoods 38, 106
 - flow velocity 38
 - maintenance 39
 - use of 39
 - See also* Ventilation
- Fungi 76
 - molds 76
 - wild mushrooms 76
- Furnishings
 - for earth science courses 106
 - for space science courses 106

G

Gas cylinders 96
 Gas supply 42
 Genetics PTC tasting 86
 Geology. *See* Earth sciences
 GFCI (ground fault circuit interrupters) 39, 95, 106, 119, 124, 201
 Glaciers 113
 Glassware 43, 95
 heated 43
 tubing 95
 tuning forks and 125
 Gloves 72, 82, 98, 101, 123, 155, 158, 202

H

Halite tasting of 110
 Handwashing 82, 110, 155
 antibiotic cleaners 156
 gels for 111, 156
 Hard hats 113, 147
 Hats 141, 147
 hard hats 113, 147
 Hazardous wastes 67, 201
 asbestos 34, 95
 biological 84
 chemical containers and 63, 93
 disposal 61–62, 62, 63, 93, 205
 pesticides 82
 stockpiling 64
 See also Waste disposal
 Hearing loss 118
 common in young people 22, 118
 noise and 119
 sound amplification for 22, 23
 speech clarity importance 22–23
 Heavy metals 85, 94, 154
 Hematoxylin 85
 Hepatitis 157, 201
 Hot plates 42, 96, 108
 Human body fluids. *See* Body fluids
 Human remains Native American 64–65

Hydrochloric acid 108
 Hygiene. *See* Infection

I

IDEA. *See* Individuals with Disabilities Education Act
 IEP. *See* Individualized Education Plan
 Independent studies 166–167
 instructor liability and 11
 Individualized Education Plans (IEPs) 19, 21
 Individuals with Disabilities Education Act (IDEA) 19–20, 201
 Infection
 from bacteria in soil cultures 111
 body fluid spill kits 87
 body fluids and 64, 80–81
 conjunctivitis 162, 200
 from eyewashes 36
 from eyewear 82, 106
 from insects 140
 from instrument eyepieces 82, 109, 162
 medications not to be given 26
 from microbes in soils 111
 precautions against 26
 Standard (Universal) Precautions 25, 64, 80, 156–157, 156, 204
 Information resources. *See* SciLinks; Websites
 Injuries
 eyewash facilities for 34, 36
 helping injured people 35, 36
 Insects 73, 77
 stinging EpiPens for anaphylactic shock 140, 158–159
 Instructors. *See* Faculty; Laboratory assistants
 Instruments
 eyepiece contamination 82, 109, 162
 meters 125
 optical 109
 weather 109

See also names of specific instruments

Insurance 180–181
 Internet 165
 course platforms 17, 165, 199
 e-mail communication with students 27, 164–165
 faculty discussion forums 7
 getting assignment answers from 165
 helping disabled students via 27
 MSDS sheets online 165
 online forums for students 17, 27
 plagiarism from 165
 putting safety instructions online 5, 165
 Voice Over Internet Protocol (VoIP) 164, 204
See also Computers; SciLinks; Websites
 Invertebrates 77

L

Lab coats 12
 Laboratories 184
 cleanup procedures 82, 155–156
 food and drink in 12, 41, 95, 156, 159
 guests in 177
 housekeeping practices 82
 shared space 5–7, 32–33, 65–66, 159
 tap water 156
See also Classrooms
 Laboratory activities 152–153
 dissection 83–84
 involving radiation 122–123
 pace of 172
 preparation time for 170
 tasting of substances 86, 110, 159
 using bacteria 74–75
 using food items in 159
See also Lesson plans; Teaching effectiveness
 Laboratory assistants 9–10, 31, 92, 177

Index

- access to chemicals 92, 92
- dress rules 12, 160
- English language fluency 24
- on field trips 135
- training 32
- work rules 53
- Laboratory courses. *See* Science courses
- Laboratory design 29–30, 30, 170, 184
 - adequate work space 93–94
 - carpets 34, 153–154
 - chemical storerooms 59–60
 - for computers 121
 - for different subjects 33
 - electrical outlets 40, 119, 120
 - electricity 39–40, 119–120
 - emergency showers 37
 - exits 170
 - faucets 36
 - floor plans 33–34
 - floors 22, 34, 153–154
 - fluorescent lights 42
 - gas supply shutoff 96
 - GFCI protection 39, 106, 201
 - lighting 41–42
 - for physics 134
 - safety checklist 34–35
 - signage 45, 74
 - sinks 21, 22, 35–36
 - student paraphernalia
 - storage 30, 66, 94, 106, 160
 - telecommunications
 - connections 40
 - wastewater treatment 36
 - water availability 30, 35–36
 - workstations 33–34, 40
 - See also* Prep rooms; Storage; Ventilation
- Laboratory equipment 184
 - air tools 108
 - alcohol burners 43, 96, 108
 - borrowing of 167
 - for disabled students 17, 20
 - disposal of 65
 - for earth sciences 107–109
 - electrical 95, 108
 - electronic 52, 95
 - electrophoresis apparatus 95
 - fire extinguishers 43–44, 44
 - gas burners 42
 - gas cylinders 96
 - gas generators 95
 - heat sources 42–43, 96, 108
 - latex rubber items 72, 202
 - loaning to other schools 98, 167
 - mercury-filled instruments 94
 - noisy 108
 - in nonlab classrooms 31
 - nonlatex items 72, 202
 - optical instruments 109
 - preserved specimens 56, 64, 83
 - storing 54
 - tubing and connectors 95
 - weather instruments 109
 - See also* Chemicals; *names of specific equipments and instruments*
- Laboratory furniture 184
 - anchoring of 50–51
 - appliances 41
 - cabinets 55, 55–56
 - glass-fronted cabinets 55
 - movable carts 51
 - refrigerators 41, 51, 86–87, 160, 201
 - shelves 56, 94
 - stools 41, 66, 94, 106
 - tables 22, 40–41, 124
- Laboratory safety. *See* Safety practices
- Lasers 126, 201–202
 - safety standards 126, 199
- Latex 72, 158, 202
- Law
 - accommodation for disabled students 18
 - Americans With Disabilities Act of 1990 18–19, 78, 199
 - defense against litigation 179
 - dress code legality 160
 - Family Educational Rights and Privacy Act (FERPA) 169, 200
 - Individualized Education Plan 19, 21
 - Individuals with Disabilities Education Act 19–20
 - instructors' legal responsibilities 177–178
 - Resource Conservation and Recovery Act regulations 93
 - state regulations on disabled students 19
 - students' privacy 169
 - terminology 178
 - vocational plan requirements 19–20
 - See also* Liability
- LD₅₀. *See* Lethal dose₅₀
- Lesson plans
 - independent studies 166–167
 - instructor's right to participate in IEP formulation 21
 - practical application emphasis in 12
 - practical application examples 12, 13
 - student attention span and 8–9, 152
 - See also* Laboratory activities; Teaching effectiveness
- Lethal dose₅₀ (LD₅₀) 99, 202
 - of specific chemicals 100
- Leyden jars 126
- Liability 31, 171–172
 - for accidents 20
 - administrative copies of e-mail messages to students 165
 - chemical disposal and 63
 - chronically disruptive students and 133, 137
 - class size and 31
 - college administration and 21, 31
 - defense against litigation 179
 - during field studies 135
 - for equipment loaned to others 167
 - field study waivers 132

- independent studies and 11
 instructors' legal responsibilities 177–178
 insurance 180–181
 malicious use of materials 51
 for out-of-class assignments 11
 private vehicles on field trips 136
 safety problem documentation 46, 180
 with shared classrooms 32
 students' clothing for given weather conditions 145
 for students' field trip "acquisitions" 131
 syllabuses as contracts 7–8
See also Law
- Life jackets 109, 114, 139
 Light ultraviolet radiation 118–119
 Lighting 41–42
 fluorescent 42
 for security purposes 52–53
 Lithium chloride 100
- M**
- Magnesium strips 207
 Magnets 126–127
 Maintenance staff 66, 83, 163–164
 Mammals 73, 78–79
 Manometers 125
 Marine environments equipment use in 52
 Marine microcosms 139
 Material safety data sheets (MSDSs) 33, 56–57, 57–59, 63, 108, 165, 185, 202
 Medications 26
 Mercury 154, 206
 in instruments 34, 94, 125
 Meters 125
 Methyl orange 85, 100
 Methyl red 85
 Mice. *See* Rodents
 Microbes bioprospecting for 111
 Microbiology safety practices 74–75
- Microinvertebrates. *See* Bacteria; Protista
 Microwave ovens 108
 Minerals identifying by taste 110
 toxic 110
 Mitts. *See* Gloves
 Molds 76
 environmental survey of 76
 from invertebrate cultures 77
 Momentum carts 124
 Monitors (cathode-ray tubes) 125
 MSDS. *See* Material safety data sheets
 Mutagens 202
- N**
- Naphthalene 100
 National Fire Protection Association (NFPA) 44, 163, 202
 National Science Education Standards 1, 15, 109
 defined 202
 National Science Teachers Association (NSTA)
 online journals 9
 position statement on multicultural education (website) 28
 position statement on safety (full text) 209–210
 SciLinks web portal x
 Natural science. *See* Earth sciences; Space sciences
 NFPA. *See* National Fire Protection Association
 Nicotine 100
 Noise 108, 119
 sound demonstrations 125
 Non-native species 79–80, 149, 202–203
 NSTA. *See* National Science Teachers Association
- O**
- Occupational Safety and Health Administration (OSHA) 96, 163, 203
 laser standards 126
 noise standards 108
 Standard (Universal) Precautions 25, 64, 80, 156–157, 156, 204
 Odors 100–101
 Oscilloscopes 125
 OSHA. *See* Occupational Safety and Health Administration
- P**
- PDA's (personal digital assistants) 143, 148, 203
 Pendulums 124
 Personal flotation devices (PFDs) 109, 114, 139
 Phenylthiocarbamide (PTC) 99, 100
 tasting of 86
 Phosphorus 100, 207
 Photogate timers 125
 Physics 186
 field studies 123
 light 118–119
 "magic trick" shows 127
 objects in motion 117–118
 radiation activities 122–123
 sound 125
 students' backgrounds in 117
 Picric acid 61, 207
 Plants 73
 allergic responses to 140–141
 exotic species 79–80, 200
 poisonous 140
 Poison Control Center telephone hotline 99
 Potassium chlorate 207
 Potassium cyanide 207
 Potassium (elemental) 207
 Pregnancy chemical exposure and 169
 Prep rooms 50, 51, 92, 203
 access to 32, 52–53, 168, 170, 181–182

Index

- security lights 52–53
See also Laboratory design
- Protective gear
aprons 97
eyewear 82, 96–97, 106, 107
face shields 97
for field studies 109, 113
gloves 72, 82, 98, 101
hard hats 113, 147
laboratory dress rules 96, 98, 123, 160
life jackets 109, 114, 139
personal flotation devices 109, 114, 139
radiation and 123
tongs 98
See also Safety practices
- Protista 75
- PTC. *See* Phenylthiocarbamide
- R**
- Radiation 122–123
dress requirements and 123
See also Ultraviolet radiation
- Refrigerators 41, 51, 86–87, 160, 201
- Reptiles 73, 78
- Resource Conservation and Recovery Act regulations 93
- Ripple tanks 109, 125
- Rock hammers 107
- Rock saws 107–108
- Rock tumblers 108
- Rodents 73, 79, 140
- S**
- Safety instruction
for disabled students 21
English language fluency and 25
on fires 44
key points 6
for language-disabled students 20
for late registrants 5
in non-English languages 20
online posting of 5, 165
- penalty for not attending 8
providing a written version 11
- recordkeeping importance of 11
- repetition essential in 11, 20
- student attention span and 8–9
- in the syllabus 6, 164
- testing students on 171
- web-based tutorials 5
- Safety practices 175–176, 183
- biology laboratory
housekeeping 82
- body fluid spill kits 81
- changes in 3, 4–5
- cleanup procedures 82, 155–156
- disinfection 82, 155
- electrical cords 40
- for electrical equipment 122
- extension cords 40, 119, 120
- with glass tubing 95
- handwashing 82, 110, 111, 155, 156
- instructor as role model 12
- laboratory dress rules 96, 98, 123, 160
- in microbiology studies 74–75
- in nonlaboratory classrooms 31
- overcrowded facilities and 30–31
- pinhole reflection for observing solar eclipses 112
- at science fairs 167–168
- Standard (Universal) Precautions 25, 64, 80, 156–157, 156, 204
- supervision of laboratory assistants 9–10
See also Protective gear
- Satellite imagery 115
- Science courses
assigning laboratory partners 16
introductory 2
laboratories as independent units 10
- Science equipment. *See* Laboratory equipment
- Science fairs 167–168
- Science rooms. *See* Classrooms; Laboratories
- SciLinks x
- AIDS 81, 194
- allergies 140
- astronomy 112, 195
- bacteria 75, 193
- chemical safety 50, 193, 196
- electrical safety 120, 196
- electricity 120, 196
- fire extinguishers 44, 192
- fungi 76, 193
- hazardous waste 61, 85, 193, 194, 197
- invertebrates 77, 193
- learners with disabilities 16, 191
- noise pollution 118, 196
- preserving ecosystems 148
- protista 75, 193
- salmonella 84, 194
- viruses 80, 194
See also Internet; Websites
- Security 168, 170
access to storage and prep rooms 32, 52–53, 168, 170, 181–182
for animals 73
glass-fronted cabinets 55
lighting for 52–53
- Serratia marcescens* 75
- Sharp instruments 83, 95
disposal of 157
for dissection of organisms 83
for Earth science activities 107
inventory of 158
- Shoes. *See* Footwear
- Showers for emergencies 37
- Signage 45, 74
labeling chemicals 45, 54, 102
- Signal generators 125
- Silver cyanide 207
- Siren disks 125
- Sodium chloride 100
- Sodium (elemental) 207

- Sodium hydroxide 207
 Sodium nitrate 100
 Soil samples 110–111
 pathogens in 111
 Solar eclipses
 eye protection types of 112
 pinhole reflection
 observations 112
 Sound 125
 Space sciences 111–112, 186
 as elective courses 105
 room requirements for
 105–106
 satellite imagery 115
 Spark igniters 95
 Spectrometers 95
 Springs 125
 Standard Precautions 25, 64,
 80, 156–157, 156, 204
 Standards
 ANSI 199
 eyewash 199
 laser safety 126, 199
 noise 108
 for protective goggles 107,
 161, 199, 201
 Storage 41, 49
 cabinets 55, 55–56, 59
 in classrooms 54–55
 of electronic equipment 52
 of flammable liquids 43,
 59, 92
 of gas cylinders 96
 of laboratory equipment 54
 malicious use of materials
 and 51
 of ongoing projects 32
 organization of stored
 chemicals 59–61
 for physics equipment 124
 of radiation sources 123
 of rock and mineral
 collections 109–110
 shelves 56, 94
 space limitations and 67–68
 for students' paraphernalia
 30, 66, 94, 106, 160
 See also Laboratory design
 Storage of chemicals 31, 54, 55,
 59–61, 106, 184–185
 cabinets for 59–60
 organizing by characteristics
 59–61, 93
 rooms for 32–33, 50, 92,
 106, 184
 storeroom design 59–60
 Storerooms 184–185, 204
 access to 32, 52–53, 92, 92,
 168, 170, 181–182
 for chemicals 32–33, 50,
 59–60, 92, 106, 184
 clutter in 67–68, 68–69
 for individual faculty
 members 53, 66
 lock systems 51–52
 security lights 52–53
 Streak plates 107
 Stream tables 109
 Strobes 126
 Student assistants. *See*
 Laboratory assistants
 Students
 attention spans 8–9
 as biology subjects 64,
 80–82
 chemistry knowledge
 89–90
 class size 30–31, 170
 comprehension hearing loss
 and 23–24
 disruptive documenting
 behavior of 133, 137
 English language learners
 9, 11, 23
 ethnicity apparent
 comprehension and
 9, 24
 group interaction 8
 heterogeneity in
 community colleges 2,
 3–4, 15–16
 laboratory dress rules 96,
 98, 123, 160
 late registrants 5
 life skills of 9, 13
 low achievers 25
 low sense of fate control 25
 measuring personal
 characteristics 81–82
 medical information for
 field work 131–132
 paraphernalia storage 30,
 66, 94, 106, 160
 parental permissions for 82,
 131–132
 privacy rights 169
 social handicaps 25
 See also Disabled students
 Substance abuse 26
 Sun observation 109, 111–112
 eyewear types of 112
 pinhole reflection method
 112
 Sunblocks 141, 141
 Sunglasses 112, 141
 Syllabuses
 course expectations
 defined in 25
 disability coordinator listing
 in 26
 failure to do assigned
 work specifying
 consequences of 25
 as legal contracts 7–8
 safety instruction in 6, 165
 unsafe behavior specifying
 consequences of 25
- ## T
- Talc 110, 204, 207
 Teaching effectiveness 151–152
 apparent vs. actual
 comprehension 9, 24
 class size 30–31, 170
 classroom clutter and 12
 course materials 17
 course platforms 17, 199
 online forums for students
 17, 27
 setting high expectations 12
 See also Laboratory
 activities; Lesson plans
 Telephone numbers
 EPA ventilation information
 37
 Poison Control Center
 hotline 99
 Telephones 164
 documenting voice mail
 messages 164
 for emergency use 164

Index

Voice Over Internet
Protocol (VoIP) 164, 204
See also Cell phones
Telescopes 110
Toluene 85
Toluidine blue 85
Tongs 98, 123
Tools carpentry 124
Toxic substances guidelines
for handling 101
Toxicity of specific chemicals
100
Tuning forks glassware and 125

U

Ultraviolet radiation 118–119,
126, 204
exposure on field trips 141
sun protection factor (SPF)
141, 203–204
See also Radiation
Universal Precautions 25, 64,
80, 156–157, 156, 204
Uranium 110
U.S. Environmental Protection
Agency 200
chemical disposal
regulations 93
ventilation information 37
UV. *See* Ultraviolet radiation

V

Van de Graaf generators 126
Ventilation 30, 37–38, 101, 106,
153
of chemical stockrooms 50
EPA information telephone
number 37
See also Fume hoods;
Laboratory design
Visually impaired students 22

W

Waste disposal
accumulated clutter 68–69
biological wastes 64, 77, 81,
82, 156

bones 64–65
chemicals 61–63, 61, 62, 205
equipment 65
laboratory animals 77–78
maintenance staff and 66,
83
non–native organisms
79–80, 149
sharp items 157–158
See also Hazardous wastes

Water

availability in laboratories
30, 35–36
collecting samples 75
field studies involving 114,
132, 138–139
pond water 75
potable 156, 203
protists in 75
tap water in laboratories
156
wastewater treatment 36
Weather forecasts for field
trips 145
Weather instruments 109
Websites 190–198
biosafety 87–88, 194–195
chemical safety 70, 102–103,
193, 195
for field studies 150,
196–197
on fire extinguishers 44
incompatible chemicals 93
legal information 182, 198
National Fire Protection
Association 44
NSTA online journals 9
OSHA standards 108, 126
phenothiocarbamide (PTC)
86
physics 128, 196
safety of science facilities
48, 173, 192–193, 197–198
on student disabilities 28,
191
waste disposal 70, 193
See also Internet; SciLinks
Wheelchair accommodations
18, 21–22, 34

Y

Yeasts 76

Z

Zoonotic diseases 73, 78, 79