A SourceBook Module

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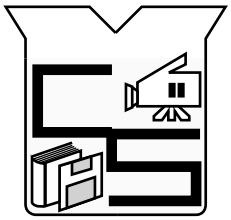
ChemSource Project Principal Investigator:
Mary Virginia Orna, OSU
Department of Chemistry
College of New Rochelle
New Rochelle, NY 10805
Phone: (914) 654-5302
FAX: (914) 654-5387



ChemSource

Instructional Resources for Preservice and Inservice Chemistry Teachers

USER'S GUIDE

ChemSource Overview

ChemSource is an array of linked products consisting of two major components: *SourceBook* and *SourceView*.

SourceBook is a resource providing specific teaching tips and the best available instructional ideas and information gleaned from experienced, successful chemistry teachers. The core of *SourceBook* is thirty-six content modules featuring in each: Content-in-a-Nutshell, Laboratory Activities, Demonstrations, Common Misconceptions, Humor, Applications and Implications, Analogies, Reference resources, History, and Media. General materials on pedagogy, classroom management, safety, teaching chemistry to the physically disabled, and other useful resources and tabulations precede and follow the content modules.

SourceView consists of five-plus hours of videotapes of exemplary chemistry instruction at the high school level. Twelve teachers and their students are portrayed in twenty-one learning/teaching episodes in their actual classrooms. Sections centered around the content area, Acids and Bases, include Beginning, Presenting and Ending the Lesson, Problem Solving, and The Laboratory. The accompanying teacher's guide includes sections on Suggestions for Use, Teaching Skills Inventory, Overview and Bibliography, Reproducible Coding Sheet, Lesson Outlines and Transcripts, Episode Questions and Answers, Coding Sheet Answer Key, and a time coded matrix for indexing the lessons involving particular skills. The videotapes may be used individually by the novice teacher or a student teacher/cooperating teacher team as a resource for teaching techniques or by preservice chemistry teachers in university methods classes as a tool for developing teaching strategies.

• The primary purpose of *ChemSource* is to provide chemistry teachers with quality support to enhance their effectiveness in the classroom. *ChemSource* can be useful to beginning chemistry teachers who sometimes find the experience of preparing for teaching overwhelming. In many cases, these teachers have been called upon to cross over into chemistry from other disciplines, and while they may be experienced teachers in other areas, chemistry is a new field to them. In addition, many schools have only one science teacher, so the built-in chemistry mentors in larger institutions are not readily available in the one-science-teacher school. As a day-to-day resource and support strategy, *ChemSource* can overcome many of the problems facing the teachers described above. Compiled by widely recognized high school and college teachers, the *ChemSource* materials contain ideas, demonstrations, laboratory activities, teaching techniques and strategies that experienced teachers have found really work.

• The second purpose of *ChemSource* is to provide all teachers, both new and experienced, at the high school and introductory college level, with relevant, up-to-date material over a broad range of chemistry curriculum topics. Approximately one-third of the topics covered in the *SourceBook* component of *ChemSource* relate to applied chemistry or are enrichment topics which supplement the main curricular topics in the first year chemistry course.

• The third purpose of *ChemSource* is to provide a comprehensive resource that can be applied in numerous ways: in methods courses for the preservice teacher; in summer institutes or teacher workshops as an in-service resource; as an idea bank for enrichment and research projects for TAG (Talented and Gifted) programs; as a supplement for Honors chemistry programs.

It is important to note that *ChemSource* is not meant to replace the chemistry curricula already in place. It is, as its name suggests, a resource to aid teachers in accomplishing their curricular objectives.

PHILOSOPHY OF *CHEMSOURCE*

The underlying philosophical principles that guided the development of *ChemSource* and that infuses each part with a unifying theme are:

• Teachers teach teachers. *ChemSource* is the pre-eminent example of teachers teaching teachers. Every part of *ChemSource* was planned, developed and written by active teachers.

• Cross-fertilization of ideas is essential to growth in chemistry teaching. Teachers cannot teach in isolation and remain effective. The best teachers are those who constantly learn from other teachers. *ChemSource* contains the best ideas of many active teachers from around the nation, providing a cross-fertilization possibility that teachers could previously obtain only by attending workshops and meetings.

• Hands-on activities are the most important activities. Chemistry teaching is one of the most important endeavors there is, and the most important aspect of chemistry teaching is hands-on activities, whether these be in the laboratory, in the classroom, or in the field. Every aspect of *ChemSource* has focused on these activities. Each *SourceBook* module sets forth content and its place in the curriculum; concept development through laboratories, demonstrations and discussion activities follow and take up the largest portion of each module; teaching tips to reinforce the activities then follow, but the centerpiece remains the hands-on activities in every case. Throughout *SourceBook*, laboratory activities are used inductively to introduce concepts, or deductively to verify concepts. The hands-on theme is echoed in the *SourceView* tapes. Every episode involves an activity of some sort, with an emphasis on hands-on laboratory and demonstration activities.

• Problem solving can/should be taught using higher order thinking skills. Another important philosophical underscore to the *ChemSource* project is the value of higher order thinking in the development of chemical concepts. *SourceBook* questions and follow-up activities, and *SourceView* problem-solving episodes emphasize the importance of encouraging higher order thinking for both students and teachers.

THE *SOURCEBOOK* MODULES

1. Basic Modules (written from a conceptual standpoint in which the chemical principles involved are developed and organized):

   - Acids and Bases (ACID)
   - Atomic Structure (ATOM)
   - Chemical Bonding (BOND)
   - Condensed States (COND)
   - Electrochemistry (ELEC)
   - Chemical Equilibrium (EQIL)
   - Gases (GASS)
   - Molecular Geometry (GEOM)
   - The Mole (MOLE)
   - Nuclear Chemistry (NUCL)
   - Organic Chemistry (ORGN)
   - Oxidation-Reduction (OXID)
   - Periodicity (PERD)
   - Solubility and Precipitation (PPTN)
   - Rates of Reaction (RATE)
   - Simple Chemical Reactions (RXNS)
   - Separations (SEPN)
   - Solutions (SOLN)
   - Stoichiometry (STOI)
   - Thermochemistry (THER)

2. Descriptive modules (similarities and differences in properties and behavior of elements and compounds are described and related to fundamental chemical principles):

   - Alkali Metals (ALKA)
   - Halogens (HALO)
   - Transition Elements (TRAN)

3. Enrichment/Applied Modules (presenting chemistry as a human activity, practiced by real people, with everyday life applications):

   - Biogeochemical Cycles: Carbon, Oxygen, Nitrogen (BICY)
   - Chemistry and Food (FOOD)
   - Enzymes: Biochemical Catalysts (ENZY)
   - Forensic Chemistry (FORS)
   - Industrial Inorganic Chemistry (INDL)
   - Instrumentation (INST)
   - Materials Science: Ceramics and Glasses (MATR)
   - Chemistry in Medicine (MEDI)
   - Photochemistry (PHOT)
   - Polymers (POLY)
   - Inorganic Qualitative Analysis (QUAL)
   - Chemistry of Rocks, Minerals and Gems (ROCK)
   - Chemistry of Seawater (SEAW)

4. General Materials

   - Preface (PREF)
   - Chemical Pedagogy (PEDA)
   - User's Guide (USER)
   - Introductory Module (INTR)

- Chemical Safety (SAFE)
- Teaching Chemistry to Persons with Disabilities (DISB)
- Chemistry in Your Career (CRER)
- Library Resources (LIBR)
- Professional Organizations (PROF)
- Cross-Referencing (CROS)
- Computers and Chemistry (COMP)
- Indices: Chemicals Index (INDC), Demonstrations Index (INDD), Experiment Index (INDE), Media Index (INDM), Name Index (INDN) and Subject Index (INDS)

5. *SourceBook* Editorial Policy
   - *SourceBook* Periodic Table columns will not be numbered (see *Periodicity* module, Content-in-a-Nutshell)
   - Electron configuration will be written in order of principal quantum level
   - Transition elements are defined as the elements in the *d*- and *f*-blocks (see *Atomic Structure* module)
   - Condensed formulas of organic compounds will be used throughout *SourceBook* unless ambiguity results (see *Organic Chemistry* module)
6. Definitions of Laboratory Activity Level
   - Basic — Appropriate for use in classes oriented toward general chemistry literacy. Students probably have limited mathematical skills and are not preparing for scientific careers.
   - General — Appropriate for use in classes for college-bound students who may or may not be science-oriented, but have adequate mathematical skills for data processing.
   - Honors — Appropriate for use in classes of selected students whose mathematical background, science aptitude and interest are strong. These students are probably considering careers as science professionals.
   - Advanced Placement — Appropriate for use in second-year chemistry courses which may or may not be based on AP curriculum. [Many of the honors laboratory activities could be used for AP review.]

A TRIP THROUGH A TYPICAL *SOURCEBOOK* MODULE

All *SourceBook* modules use the same organizational structure. The five major subheadings are:

- *Topic Overview*
- *Concept/Skills Development*
- *Links and Connections*
- *References*
- *Appendices*

(A sixth subheading: *Extensions and Projects* is included in many modules.)

The *Topic Overview* includes:

Content in a Nutshell - a capsulized coverage of the material in the module.

Place in the Curriculum - a statement describing how and when the topic can be integrated into the chemistry curriculum.

Central Concepts - a listing of central ideas, principles and definitions which form the basis of the module.

Related Concepts - concepts which support and relate to the central concepts.

Related Skills - skills needed by the student to carry out the module activities.

Performance Objectives - a description of what the student will be able to do after completing the activities and studying the other material in the module. Performance Objectives are a key component of effective lesson plans which tie content to student learning.

The *Concept / Skills Development* section forms the backbone of every module. Here, the user will find key activities (laboratory activities and demonstrations) which support the topic. *SourceBook* is both a laboratory book and a resource book contained in a single package.

Laboratory Activities include both the Student Version (which can be duplicated as a handout) and the Teacher Notes which provide all the information teachers need to conduct the laboratory and assess student learning. The laboratory activities in the *Concept / Skills Development* section include:

Student Version:

- Introduction
- Purpose
- Safety
- Procedure
- Data Analysis and Concept Development
- Implications and Applications

Teacher Notes:

- Major Chemical Concepts
- Level
- Expected Student Background
- Time
- Safety
- Materials
- Advance Preparation
- Pre-Laboratory Discussion
- Teacher-Student Results
- Answers to Questions
- Post-Laboratory Discussion
- Assessing Laboratory Learning

Demonstrations
Demonstrations stimulate student interest in a topic and set the stage for new ideas or reinforce material previously covered. Multiple demonstrations are included in each module so the teacher can pick and choose which to include in a lesson. Demonstrations in the *Concept/Skills Development* section include:

- Purpose/Description
- Materials
- Safety
- Procedure

Group and Discussion Activities
Cooperative learning through groupwork is an effective technique for achieving conceptual learning and creative problem solving. All modules include *Group and Discussion Activities* in the *Concept/Skills Development* section. These include but are not limited to:

- Key Questions
- Counterintuitive Examples
- Analogies and Metaphors

In addition to activities, the *Concept/Skill Development* section includes the following subtopics:

Tips for the Teacher - tips from the language of chemistry as well as common misconceptions.

History - historical development of the topic or biographical sketches of key individuals who made significant contributions.

Humor - cartoons, puzzles, drawings, anecdotes, puns, word search and crossword puzzles.

Media - commercially available films, videotapes, computer software, *etc.*

Links and Connections are a third subtopic found in each module. Connections are:

Within Chemistry

Between Chemistry and Other Disciplines

To the Contemporary World - these include links to personal experiences which relate to the topic as well as links to the community, suggesting field trips and knowledgeable individuals who could serve as a resource.

References make up the fourth subheading:
References cited in every module are written in a format which will facilitate interlibrary loans.

The *Appendix*, found at the end of each module, includes ancillary material, activities, transparency masters, *etc.* The latter are ready for duplication.

CROSS-LINKS BETWEEN MODULES

Some of the applied/enrichment modules include extensive background notes which are not likely to be found easily in standard chemistry sources. Many modules include information on specific equipment and instrumentation useful in studying the topic. Finally, a majority of the modules give ideas for extensions and research projects which could be adapted for Talented and Gifted or independent study projects.

While each module in *SourceBook* covers a particular topic, there are many links and connections between topics in other modules which can be located using the cross-referencing index. For example, while acids and bases are the subject of the module by that name, there are extensive links to acids and bases in many other modules. These links are outlined in the *Cross-Referencing* module (CROS).

Some educators consider Concept Maps a helpful pedagogical tool for review and reinforcement. While each individual may construct a different concept map for each topic, we have provided examples both below (on *Chemical Bonding*) and in the *Chemical Pedagogy* module (on *Acids and Bases*). Use of concept maps for review and assessment is also illustrated in the *SourceView* videotapes. Concept maps are most helpful when a concept is illustrated in a box or oval, and the link to other concepts in the overall topic are shown not only by connecting lines but by explanatory phrases.

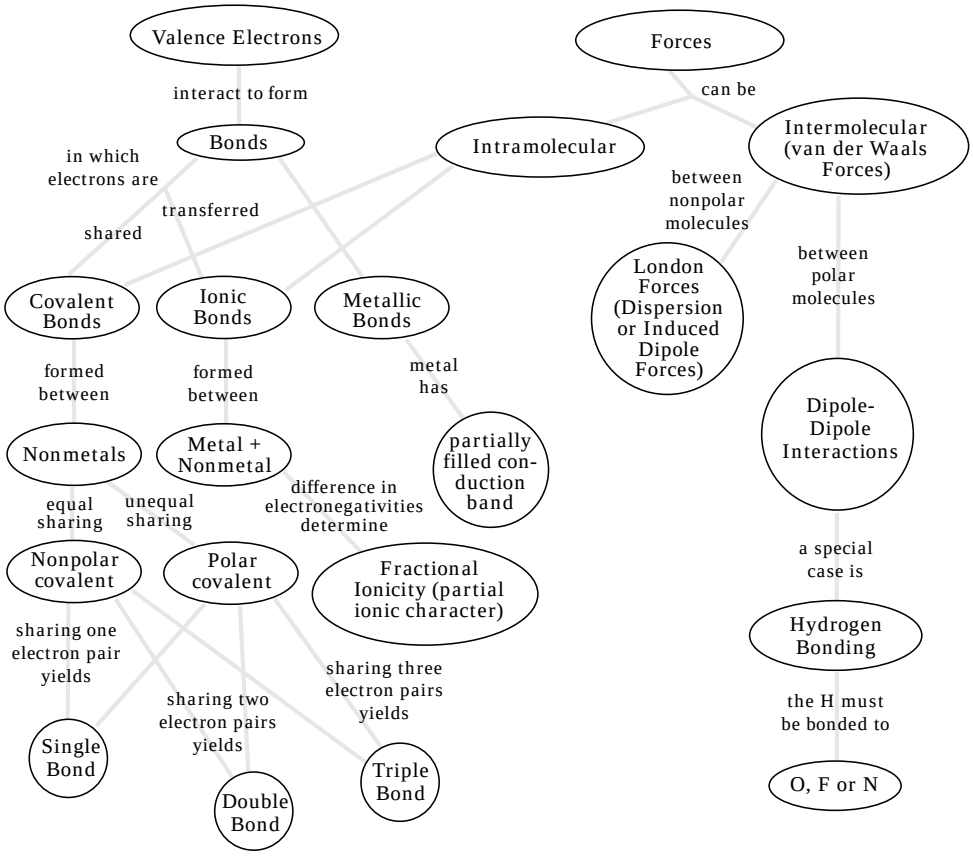


Figure 1. Concept Map for Chemical Bonding

BUILDING A LESSON PLAN USING *SOURCEBOOK*

There are several approaches to developing lesson plans which use *SourceBook* as either a primary or secondary resource. A typical topic, acids and bases, illustrates how *SourceBook* materials can be integrated into the curriculum. First, a unit plan is presented which incorporates both the regular chemistry curriculum and *SourceBook* supplementary material into a two-week unit. Two detailed daily lesson plans follow, each using *SourceBook* material in a different way. The first plan uses the module *Acids and Bases* as the primary resource for the lesson. The second plan uses the standard chemistry curriculum for teaching central concepts, and supplements with enrichment material from several *SourceBook* modules.

The daily lesson plans presented here combine course content with up-to-date teaching strategies which make use of learning theory and research findings to promote student learning. Many schools are currently using similar lesson plan formats, such as Instructional Theory Into Practice (ITIP), which include a series of teaching steps. The steps are viewed as essential to thorough lesson development. The model for the daily lesson plan used on the following pages was selected because the steps incorporated have become guidelines for evaluating teacher performance in many teacher appraisal programs currently in use. The following elements are found in the daily lesson plans:

Focus or Anticipatory Set - means of generating student interest in the lesson that follows which involves all students and builds on previous knowledge.

Performance Objectives - description of what the student will be able to do after instruction.

Explanation - techniques used by the teacher to present the information.

Modeling - ways to demonstrate the learning process visually.

Checking for Knowledge and Understanding - assessing students' understanding of the learning using key questions, *etc.*

Monitoring and Adjusting - monitoring the progress of the learning and adjusting instruction to correct misconceptions.

Guided Practice - guiding students through the problems, skills or work to be done and providing feedback to the student.

Independent Practice - student practice without teacher assistance.

Enrichment - higher level activities provided to students which extend the knowledge of the subject.

Closure - activity which brings the lesson to a close and requires the student to summarize and internalize what has been taught.

SAMPLE UNIT LESSON PLAN

Acids and Bases

Day 1 Classifying Substances as Acids, Bases, Salts [See *SourceBook*, Acid/Base module: Activity 1]

Day 2 Classifying Substances [Activity, continued]

Day 3 Conceptual Definitions and Strength of Acids and Bases [See Daily Lesson Plan using *SourceBook* as the **primary** resource]

Day 4 pH and Indicators [See Daily Lesson Plan using *SourceBook* as a **secondary** resource]

Day 5 Soil pH [See *SourceBook, Industrial Inorganic Chemistry* module: Activity 1, Part 3 and Demonstration 5]

Day 6 Neutralization, Buffers, and Hydrolysis [See *SourceBook, Acids and Bases* module: Extensions]

Day 7 Neutralization [See *SourceBook, Acids and Bases* module: Suggestions for Other Laboratory Activities - Neutralization]

Day 8 Titration [See *SourceBook, Acids and Bases* module: Suggestions for Other Laboratory Activities - Titration of an antacid]

Day 9 Review of Concepts involving Acids and Bases

Day 10 Assessment or Test on Acids and Bases

Since acids and bases are typically covered in the second semester, the time spent on this topic can be shortened or lengthened depending on the material yet to be covered in the first year. Many excellent films, videos, and environmental considerations are often used to extend the coverage on the topic of acids and bases. An important link between acids, bases and periodicity is found in the *Periodicity* module, Activity 2: Trends in Oxy-hydrogen Compounds of Period 3 Elements. If this activity was not used during the study of periodicity, it could be used as a logical laboratory extension when studying acids and bases.

DAILY LESSON PLAN USING *SOURCEBOOK* MODULE: *ACIDS AND BASES* AS THE PRIMARY RESOURCE

Acids and Bases
Day 3: Conceptual Definitions and Strength

Previous assignment due today: *SourceBook* Activity 1: Classifying Substances Based on their Reactions

Homework assignment - Due date:

Materials and equipment needed:

2 Burets
2 Ringstands
2 Clamps
2 Beakers, 250-mL
Conductivity apparatus (with 60-W light bulb if possible or small-scale apparatus with piezoelectric buzzer)

0.01 M or 0.1 M Sulfuric acid, H_2SO_4
0.01 M or 0.1 M Barium hydroxide, $Ba(OH)_2$
Phenolphthalein solution, 1% in 95% ethanol
Stirring rod or magnetic stirrer
Transparency Masters

OUTLINE OF SUBJECT MATTER AND STRATEGIES FOR REACHING TODAY'S OBJECTIVES

1. Focus or anticipatory set

a. Perform Demonstration 4, Part 2. Tie in demonstration with Activity 1 performed yesterday.

2. Performance objectives

(*SourceBook* Performance Objectives 1, 7, 8 and 11)

The student should be able to:

a. define and classify acids and bases operationally and conceptually

b. distinguish between a strong acid (or base) and a weak acid (or base)

c. present useful mental pictures of ionization, dilute/concentrated and weak/strong acids and bases

d. express opinions about the role of acids and bases in daily life.

3. Content

a. Central Concepts
   1) Conceptual definitions (#2). Include: History of Arrhenius, Brønsted and Lowry.
   2) Weak and strong acids/bases (#5, 6)

b. Related Concepts
   1) Ions (#1)
   2) Classifying acids and bases (#3)

c. Links and Connections
   1) Within Chemistry
   2) Between Chemistry and Other Disciplines

4. Modeling

a. Transparency Masters of Pictures in the Mind
   1) Ionization
   2) Concentrated/Weak; Dilute/Strong Acids and Bases

b. Metaphors and Analogies

5. Checking for Knowledge and Comprehension

a. Key questions 1, 2, 5-7.

6. Monitoring and Adjusting

a. Common Student Misconceptions. See 1-4 and 8.

7. Guided Practice

a. Students asked to describe acids and bases in operational and conceptual terms.

b. Student asked to compare and contrast the following terms with reference to acids and bases: concentrated/weak; strong/dilute.

c. (Advanced) Students asked to relate strength of acids/bases in terms of ionization constant expressions, K_a and K_b.

8. Independent Practice

a. Student will answer teacher-assigned questions on acids and bases which are found in any chemistry textbook, or

b. Student will prepare a list of 15-20 products from a grocery store which includes an acid or base as one of the ingredients listed on the label, or

c. Student will write a one-page paper on a specific link of acids and bases to another discipline. Example: environmental problems with acid rain.

9. Enrichment

a. Student might conduct library research on G.N. Lewis and/or refer to most chemistry texts for the Lewis definition of acids and bases. This more encompassing definition could be compared with the Arrhenius and Brønsted-Lowry definitions.

10. Closure

a. Students summarize definitions of acids and bases. [Operational definitions should be reviewed from the previous day's laboratory activity; conceptual definitions should be summarized from today's topics.]

b. Transparency Masters of Humor dealing with acids and bases.

[Note: The activities listed above can be performed in a typical class period. Activities 7(a), 7(b) and 10 could be used to review the material on the following day. Activities 8(c) and 9 are more long-term and could constitute a unit assignment.]

DAILY LESSON PLAN USING *SOURCEBOOK* AS A SECONDARY RESOURCE

Acids and Bases
Day 4: pH and Indicators

Previous assignment due today: Teacher-assigned questions on acids and bases generated from a chemistry textbook.

Homework assignment - Due date:

Materials and Equipment needed:

Natural indicators: Red cabbage juice, grape juice, *etc.*
Vinegar
Baking soda (sodium bicarbonate), $NaHCO_3$
6 Petri dishes, slant test tube apparatus, or 50-mL beakers
Transparency masters

OUTLINE OF SUBJECT MATTER AND STRATEGIES FOR REACHING TODAY'S OBJECTIVES

1. **Focus or anticipatory set**

   Consider the flowering shrub, hydrangea and how the flowers can be red or blue depending on the nature of the soil. [*SourceBook: Acids and Bases* module, Content in a Nutshell]

2. **Performance Objectives**

   The student should be able to:

   a. classify a solution as acid, base or neutral, given the hydrogen-ion or hydroxide-ion concentration.

   b. calculate the hydrogen-ion or hydroxide-ion concentration in an aqueous solution.

   c. define pH and perform calculations involving pH.

   d. explain why indicators change color.

   e. select appropriate indicators for acid/base solutions.

3. **Content**

   a. Central Concepts [Source: Most chemistry textbooks]
      1) Hydrogen-ion and hydroxide ion-concentration of acids and bases
      2) pH
      3) Acid-base indicators

   b. Related Concepts [Source: *ChemSource*]
      1) pH of seawater [*SourceBook: Chemistry of Seawater* module, Activity 1, part D]
      2) Qualitative Analysis and pH [*SourceBook: Inorganic Qualitative Analysis,* Links and Connections within Chemistry]
      3) Household substances and pH [*SourceBook: Food and Chemistry,* Tips for the Teacher: Shampoo and Soda Beverages]

4. **Modeling** [Taken from *SourceBook: Acids and Bases* module]

   a. Demonstration 2: Nature of Indicators

   b. Metaphors and Analogies, #1

   c. Transparency Masters
      1) Language of Chemistry: Indicators and pH; pH of Common Substances
      2) Pictures in the Mind #3 and #4

5. **Checking for Knowledge and Comprehension**

   a. Key Questions for Discussion
      1) How is an acid or base identified on the basis of the hydrogen-ion or hydroxide-ion concentration?
      2) What is pH and how is it determined?
      3) How can pH be used to classify common substances?
      4) What are indicators and how are they used in acid/base chemistry?

6. **Monitoring and Adjusting**
    a. Student will interpret the results of tests on unknown substances using indicators.
    b. Common Misconceptions #5, 6, 7 [From *SourceBook* module: *Acids and Bases*]
7. **Guided Practice** [See mathematical calculations involving pH in *SourceBook:* General Resource module]
    a. Students asked to classify a list of substances as acids or bases when hydrogen-ion and hydroxide-ion concentration is known.
    b. Students asked to calculate the pH of solutions if the hydrogen-ion and hydroxide-ion concentration is known.
8. **Independent Practice**
    a. Student will answer assigned questions on pH and indicators which are found in most chemistry textbooks, or
    b. Given strips of pHydrion™ paper, the student will determine the pH of 10 common substances located in the home or workplace, or
    c. Student will prepare a natural indicator from flower or fruit concentrate at home and test it on common acids and bases.
9. **Enrichment**
    a. Student will investigate the top chemicals used in the U.S. and determine how many are acids and bases. [*SourceBook: Industrial Inorganic Chemistry* module, Appendix]
    b. Student will write a research paper on commercial processes for the production of common acids and bases like the Ostwald, Solvay, and Haber-Bosch processes. [*SourceBook: Industrial Inorganic Chemistry* module]
    c. Student will conduct a research project on pH of lakes and streams in a given area and relate results to the presence or absence of pollution.
10. **Closure**
    a. Students summarize the relationship between acids and bases, pH, and indicators
    b. A pH rhyme [*SourceBook: Acids and Bases* module, Tips for the Teacher #5]
    c. Transparency Masters of Humor dealing with pH [*SourceBook: Acids and Bases* module, Humor]

The authors of *ChemSource* have provided a comprehensive resource for chemistry teachers. As every science teacher knows, however, new information, techniques, and strategies will continually impact the way chemistry is taught. While the materials found in the *SourceBook* modules were developed by thirty-six teachers across the U.S., a tremendous amount of experiential knowledge still resides in the thousands of chemistry teachers around the country who have developed their own bags of tricks, resources, *etc.* We welcome the contributions, suggestions, questions, and ideas from all chemistry teachers who use *ChemSource* to extend the process of teachers helping teachers. A feedback form has been provided below. Please take time to respond. Chem*Source* will never be a finished product. Periodic revisions and supplements will be necessary to continue the resource development for new and old chemistry teachers alike. Your contribution to this process is both encouraged and welcomed.

The User's Guide was developed by Beatrice Epperson and Mary Virginia Orna.

SOURCEBOOK USER'S FEEDBACK/ ERRATA FORM

(Please photocopy a separate form for each *SourceBook* section)

SourceBook is the product of twelve writing teams of three individuals each. Each team of experienced college/university and high school teachers compiled its own teaching experiences with contributions from hundreds of individuals. *SourceBook* has had many reviewers, proofreaders, and editors. Each person has tried diligently to find and correct errors of content, typing, and concept. Given the nature of this task, we believe that it is not completely possible to succeed in this effort. We have tried our best to prepare an error free resource.

We invite you to become part of an on-going review team by completing a facsimile of the form below and returning to us your corrections and assessments to be incorporated in the next edition of *SourceBook*. We also welcome additional humor, anecdotes, games, links and connections, as well as any teaching aids. For your effort, you will be credited for your contributions in the next edition.

Thank you for your understanding, assistance, and support.

Name_____Phone (_____)_____

Address_____

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_____

Module_____Part_____

COMMENTS: Did you find this *SourceBook* module or chapter useful? Why or why not? Was the material: too complicated? too simple? Were the explanations sufficient? Please comment. Did the laboratory activities and demonstrations "work?" If not, what was the problem?

IMPROVEMENTS: What additions, deletions or alternatives would improve this *SourceBook* module/chapter? Please comment.

IDEAS: What ideas for laboratory activities, demonstrations, tips for teachers, links and connections, *etc.* do you have which would enhance the useability of this *SourceBook* module/chapter? Please be specific.

ERRATA: Please identify the error and explain how it should be corrected.

SEND TO:

ChemSource Principal Investigator:
Mary Virginia Orna, OSU
Department of Chemistry
College of New Rochelle
New Rochelle, NY 10805
Phone: (914) 654-5302
Fax: (914) 654-5387