I. Introduction

Your appointment as a teaching assistant means that you have been selected by your college or university for a position of responsibility. The fact that you have been chosen in competition with other prospective assistants reflects credit both on you and on your undergraduate institution. At present this may seem to you to be simply a source of financial support while you carry on your advanced studies. In reality it means much more to the department and school you will serve, to the students you will guide in the classroom and laboratory, and to your own professional growth, regardless of whether your future is in teaching or research.

Your ability and enthusiasm as a teacher may well make the difference between success and failure for many of your students. They may be inspired or dulled, encouraged or discouraged, as a result of their experiences under your care and leadership. Recall your own experiences as a student. You will realize the extent to which certain fine teachers influenced your attitudes and your progress.

In the process of your appointment to this position scholarship records, prospects for successful pursuit of graduate study leading to an advanced degree, and attributes of personality and character have been considered with great care. You will bring to your classes, therefore, a high level of technical and scientific ability; but these must be supplemented by some careful attention to the details of your new job as teacher.

You are a part of a team (comprising lecturers, teaching assistants, and other staff) which will teach and guide the students in the progress of their learning of chemistry. Full cooperation among the members of this team is essential. Make a sincere effort to know what the rest of the team is doing: attend the lectures or other meetings of any course you are concerned with, and become familiar with the textbooks, methods, and general planning of the course. Many departments hold regular meetings of the assistants. On these occasions you will have a fine opportunity to discuss your problems with others and to obtain their suggestions and counsel. Every department has certain regulations, policies, and customs of operation. Obviously it is to your advantage to become thoroughly acquainted with these as quickly as possible.

Remember also that you as teaching assistant in this team will have—in the laboratory and in recitation or conference—the most frequent opportunities for direct personal contact with students. The lecturer and others may have very little chance to know students as individuals.

It is the purpose of this handbook to set forth certain concrete suggestions and directions to aid you in your teaching. It is impossible to cover all possible problems and situations which may arise, but experience has shown that there are many general and specific matters with which every teacher will probably have to deal. New assistants in particular will welcome guidance during their first year. A handbook can also serve as a useful review and check-list to you in later years, as you work to build through experience the habits and techniques which can make a really fine teacher.

Many of the points mentioned may seem obvious, but it should be remembered that most mistakes—in teaching as elsewhere—can be traced to oversight of points which should have been obvious. Just as a good pilot goes through a basic check-list of his plane before every takeoff, regardless of how many times it has been done before, the good teacher will know certain points to be checked habitually and regularly in every teaching situation.

You will want to know how to organize your work for the greatest effectiveness, how to deal with the student problems, and how to win and hold the respect of your students and your colleagues, as well as what safety practices and other features are peculiarly significant in teaching chemistry.

The training you undergo will include practical experience in public speaking, writing, and organization of activities. You will find that your own educational and cultural horizons will be developed and broadened. You will learn a good deal more of chemistry and acquire an increased ability for self-expression, a greater knowledge of human relations, and a professional experience that will mean much in later years.

It is hoped that the information contained in this booklet will be of genuine service in your development as teacher. The handbook form has been used so as to make its contents readily accessible to you at all times.

II. Conducting a Discussion Class

A discussion class or recitation section gives the student an opportunity to resolve subject matter difficulties, and gives you as his instructor an opportunity to observe the student’s progress. Written quizzes, problem assignments, or oral testing may be used for the latter purpose, and time is also reserved usually for questions raised by students. You will in the course of your experiences develop your own effective teaching techniques; but as the teaching role is a new one for you the suggestions which follow can help. You can also obtain special advice as needed from the professor in charge and from other experienced assistants.

Preclass

You should be present in the room before the scheduled class-opening time. Clean the board if necessary, and make certain that the room is lighted and well ventilated. Check your record book for attendance, and familiarize yourself with each student’s name and face.

The student’s respect for you and thus a part of your
effectiveness is related to your appearance. Dress neatly and carefully so that your appearance gives the impression that you consider seriously the responsibility of your teaching position.

**Written Quizzes**

If a short quiz is to be given and the lecturer has not designated a specific portion of the period for it, you may find it desirable to begin the period with some discussion. When you are ready for the quiz, write the previously prepared questions on the board, or better, distribute duplicated question sheets or use an overhead projector. If you write on the board, use clear large letters which can be seen from anywhere in the room. Make sure that the students hand in their answer sheets promptly when asked to do so. Usually the best time to discuss the answers to the questions is immediately after the quiz.

When giving a written quiz, give your entire attention to the job at hand. Be alert and attentive; do not go off to a corner to read or to converse with your colleagues. This is not the time to sit down and relax, nor to grade papers, nor to prepare for your own courses. Vigorous, alert, honest proctoring can minimize dishonesty. It is much better to prevent dishonesty than to have to apprehend a culprit for punishment. However, know in advance what to do if you discover a student cheating: i.e., consult the professor in charge for directions before it happens.

The establishment of a physical and mental atmosphere to encourage the personal integrity which is so important in science is critical. Some schools may, of course, use an honor system for this and will then have special local procedures to be followed.

**Construction of Tests**

The proper formulation of questions for any test requires thought. Careful consideration of relative importance of items to be covered is necessary. In this matter the advice of the experienced faculty members will be of great value. Writing good questions is hard work.

Written quizzes will most often be on currently assigned subject matter, but an occasional “review” quiz, or one on the advanced reading assignment designed to test a student’s preparation, is also useful. Stick to the subject and to the main issues; ask only questions which pertain to the course and its objectives. Be sure you are in accord with the lecturer at all times in notation, etc. In stating questions, avoid ambiguity: rework them until they are clear, clean-cut, and not open to misinterpretation by the student. Then his answers will be more to the point, and you will avoid arguments about grades.

Different types of questions which you may use on occasion are given in the following list:

1. **Essay questions.** You may at times use questions which require a brief discussion for an answer. This kind of question requires the student to express his thoughts in words, to organize and utilize his knowledge of the subject matter, and to reason from principles. When questioning students regarding the definition of new terms, it is good policy to expect illustrations of such terms in the answers. (Example: “Define and illustrate . . .” is superior to “Give a definition of . . . ”.) Questions requiring short concise answers are advised.

2. **Problems** are excellent items for quizzes. Remember the time limit. Test the problems by working them yourself and make certain that they have clear-cut and reasonable answers and that you can do them (including any necessary writing) in a fraction of the time you allow the student for this purpose. A good rule of thumb is to give the students ten minutes for what you can do in two. Some arithmetic solutions can be time wasters. If they involve lengthy calculations you may sometimes require only the “set up” of the solution. In addition to amplifying scientific principles, problems give experience in using and understanding units, dimensions, and significant figures.

3. **Equations** are useful and important means for expressing changes in chemical composition. They are the simplest way of representing the stoichiometry between reactants and products. They do not refer to mechanisms of reactions unless designed specifically to do so. The ability to write and balance common equations is fundamental in any quiz program. Avoid obscure or unimportant reactions, however, and those equations which are too involved.

4. **Charts, graphs, and diagrams of apparatus can often be worked into a test, particularly one which may include coverage of some laboratory work. For example, a simple solubility chart, showing the curves for several salts, may be incorporated into a question, and the students asked to interpret the data. Questions may be asked such as: “What is the solubility of sodium nitrate at 40°C?”; “Which is more soluble at 60°C, sodium nitrate or potassium nitrate?”; “Why is it more difficult to purify sodium chloride by recrystallization than potassium nitrate?”

5. **Multiple-choice questions** require care in formulation, but are excellent both from a learning and from an objective-testing viewpoint. An example of such a question might be: “Encircle the answer(s) which best completes the statement: Hydrogen ion is a strong enough oxidizing agent to oxidize (a) copper, (b) aluminum, (c) silver, (d) carbon, (e) platinum.”

6. **Completion tests** are very difficult to construct because a variety of correct or partially correct answers other than the desired one are usually obtained.

7. **Matching questions** require the use of enough choices so that the student cannot evade the purpose of the question by some form of guessing or luck. To get ideas on these, look over some standard examinations, such as those of the ACS.

8. **True-false questions** are subject to a number of valid objections, particularly in connection with the problem of clarity. The assistant should not attempt these, or should use them only sparingly.

There are certain advantages and disadvantages in both the “essay” type of questions and the “objective” type—multiple choice, matching, true-false, and completion questions. Properly prepared questions of any type must require thought in answering. The essay type permits more self-expression and organization of material on the part of the student, and gives more opportunity for discrimination. However, it is also difficult to evaluate; different instructors may assign different grades to the same paper. The other types, if properly composed, require just as much
thought in answering. Because of the form, it is possible to test the students more uniformly and with a wider sampling of subject matter. Consistent grading is easier and less time-consuming but preparing the objective quiz is much more difficult than preparing the essay type. Probably the well-considered use of all types is the best procedure. All are objective when properly applied to chemical information and reasoning, because the answer can be clearly either right or wrong and will not be arguable as to interpretation.

Oral testing differs but little from the written form. Be sure to have enough questions written out beforehand, and have them as well formulated as you would prepare for a written quiz. Be sure to have the complete attention of the class. State the question first and then call on a student by name. In this way the whole class will be alert and trying to figure out the answer before the individual student is called on. Know your students by name, and do not just point out someone or select only those who volunteer. Cover the entire class; do not fall into the error of continually calling upon the good student, unless it is to amplify or correct an answer, or others have passed it by. Try to obtain a maximum of student participation. Be sure that all hear and understand the question, and that the answer is proper and complete and reaches the entire class.

Grading Practice

Grade justly and fairly, but "have a heart." Read a variety of representative answers to a question first to establish your standards for grading, then read that question for all papers. Return papers promptly with corrections indicated. Go over your quizzes with the class either immediately after the papers are collected, or else when graded or corrected papers are returned to the students.

The inexperienced often grade more severely than experienced teachers. It is suggested that after grading a few sets of papers, you should consult with an experienced teacher regarding your grading. Much can be learned by such consultations. A correct start in this will aid materially in subsequent teaching.

Discussion Sessions

This portion of the class hour may be opened by asking if anyone has a question on (a) the assigned lesson material, (b) past lecture or laboratory work, or (c) problems. Some questions will usually be asked by some of the better students in the class. (Slow students are usually not very active in recitation. The instructor must make an effort to stimulate activity on their part in discussion classes.) Keeping an informal atmosphere, which should characterize a recitation period, call upon other students to answer the questions raised. Do not let this drag. If proper answers are not offered, give the necessary explanation of the topic and then proceed to another. Avoid lecturing during the discussion periods. Give a brief but concise answer for each specific question.

Induce student participation whenever practical and possible. If a given response is not completely correct, acknowledge the valid portion and ask another student to complete the unsatisfactory part. If the students run out of questions, be prepared to ask questions of your own.

Take special pains to call on the average and below-average students for their share of the answers. On the other hand, do not completely ignore those who have hands up and desire to contribute. Make a special effort to call on all types of students at each class meeting. One may not be able to have all students take part at each session, but he should attempt to have participation from each scholastic grade-type, regardless of the nature of the performance.

Obviously questions will arise from time to time which you cannot answer. Do not bluff; merely announce that you will find out the answer and report to the class at a subsequent meeting. Find the answer and do not fail to present it.

Work at the blackboard for problem solving is another useful technique for recitation. You may send several students to the board at one time with each student being given a different problem for board work, while those at their seats are assigned the same problems to check for errors in the work on the board. If space permits, the whole class may occasionally be sent to the board at one time. This is an inefficient process in number of problems covered, but it does give the instructor a bird's-eye view of who knows what and where the difficulties lie. Try to plan board work ahead so as to minimize confusion and time lost in going and coming.

End of Period

Budget your time to cover satisfactorily the anticipated material in the time allotted. Consider carefully both time and subject matter when preparing a lesson plan. This is sometimes difficult to do, since questions from the students may require more time than expected. If you observe that the period will end before all important material has been covered adequately, stop in time to outline briefly the high points of remaining material, but don't take time to lecture.

Occasionally you will become so engrossed in a topic of discussion that the end of the period will find you still in the very midst of the topic. (This is not ideal, but in many cases is the real situation.) Even so, dismiss the class punctually. Do not hold them after the bell. On the other hand, it is NOT good practice to dismiss a recitation class much before the end of the hour.

Be sure that the material for which the students will be responsible at the next class meeting has been clearly defined and assigned.

After the bell rings, erase the board, pick up your papers, and leave within 3–4 minutes to give the next instructor an opportunity to start his class.

Special Situations

Recitation periods immediately before a major test, a school recess, or the final examinations (last class of the term) may require a procedure somewhat different from that of the usual discussion period. At such meetings it may be desirable to omit the short ten-minute quiz. The discussion period preceding a major test is usually filled with the many questions raised by the students. These questions can be answered by another student, or by the instructor himself.
if he feels time can be saved and efficiency increased by doing so. Sometimes one can let a number of questions be asked, then discuss them as a group.

Meetings just preceding or following recess periods (Christmas, spring vacation, etc.) are often a problem because of restlessness of the students. The rapid-fire oral question-answer technique has been found to be successful in this type of period. In any event, give them their money’s worth at such times. Do not dismiss the class early.

Other Comments

Attendance Records. Various schools will differ in procedures regarding students who miss class, but it is commonly desirable for all teachers to maintain an accurate attendance record. This is particularly important in a freshman class, for the Dean’s Office or parents may often make inquiries about freshman participation and attendance in class.

Guidance Suggestions. The inexperienced assistant should always feel free to confer with more experienced staff members for guidance and suggestions regarding class instruction as well as personal course work. There is no criticism attached to such conferences—they are welcomed at all times.

Handicapped Students. It is well to show consideration for handicapped students. This includes those who have difficulty in vision, hearing, speech, or muscular coordination. Seating arrangement and laboratory desk assignments must take these factors into account, and tardiness may be excusable in many cases. The assistants in recitation or laboratory sections have, of course, the best opportunities to spot individual handicaps.

Uniformity of Presentation. In teaching chemical principles and methods of working problems, be sure your procedures are in harmony with those used by the students’ other instructors in the course. Otherwise a state of confusion is sure to result. Consult the lecturer with whom you work to determine the preferred methods of presentation.

Attitude Toward Students. In class or out of class always maintain an attitude of friendliness and fairness. The good teacher shuns the use of sarcasm or undue display of emotion in dealing with student weaknesses. Address students in a friendly but formal manner in class or out. Participate in faculty-student activities on occasion. Be friendly, fair, and firm at all times.

Preparation. Probably the most important admonition for you to bear in mind is to be prepared always. Inadequate preparation for instruction may be reflected through students’ justifiable complaints to Deans or Professors. Consideration of the items mentioned in the above paragraphs will keep such adverse reports to a minimum.

III. Conducting a Laboratory Class

The laboratory is an essential phase in training the student in chemistry. It may be part of a course, the other parts being lecture and recitation, or it may be a course in itself. In either case your responsibilities as instructor are likely to be numerous and varied. The remarks following can be helpful as a check-list of these responsibilities.

Before the Bell

Make it a habit to be present several minutes before the scheduled opening time. As instructor you are responsible for the adjustment of lighting, heating, and ventilation in the room. Gas, water, and air outlets should be checked on entering. The condition of the sinks and of balances and other instruments must also be checked. Report any mechanical difficulties, such as leaking faucets or burned-out light bulbs, to the proper individuals.

If it is necessary to use special apparatus, e.g., burets or conductivity units, you should see that this special equipment is available to the students at the beginning of the period.

Check to see that reagents needed for assigned experiments are available. Special reagents such as standard solutions are usually furnished through the storeroom, but it may be necessary for you to see that your own section is supplied without delay.

Notations regarding the assignment may be written on the board, including any changes, omissions, or substitutions. Be prepared to answer questions on the assignment.

The Laboratory Period

Begin class promptly. Make necessary announcements and demonstrations. Call attention to specific directions for the assignment but keep the time for such talks to a minimum. Then, encourage students to take up their own work quickly. Students should work at their assigned desks unless specifically told to work elsewhere or in groups. Try to be readily available so as to make sure that each student performs the experiments properly and to offer suggestions where needed to help him obtain satisfactory results.

Once class routines are well established you are likely to find your time fairly well taken up in answering questions. However, it is desirable whenever possible to observe the various students in their actual performance of laboratory work.

Try on occasion going from one to another to ask questions concerning the experiments: ask a student what he is doing, and expect him to answer without reading from the manual. If an apparatus has been set up, ask him to explain its function and perhaps the function of the different parts. Ask to see his record of data. Insist that records be kept dated and current with the work and that they truly record his own observations. Other questions will suggest themselves with practice.

Watch regularly for opportunities to give help in developing good laboratory techniques and courtesy—for example, the need to keep corrosive chemicals or reactions, etc., away from balances or other special apparatus, or from one’s neighbor’s notebook.

While marking the rounds, it may be well also to discuss the reports of the previous period, to make suggestions and to explain notations.

Effective teaching in the laboratory requires continuous contact with the students and their work. Make a definite effort to visit each student at least once during each laboratory period.

If the student is required to hand in a report before leaving, the report should be brought to you personally. If the time permits you may on occasion ask questions
about the experiment or discuss with him the quality of the work. Such procedures can help to discourage hurrying through the performance of the experiments in order to leave the laboratory early. (These reports should be returned to the student, if possible, at the next laboratory period.)

The laboratory instructor, as well as the student, should be in the laboratory throughout the period. Lounging about a stockroom or corridor is not acceptable practice. The laboratory period is not a time to relax, to grade papers, or to study for your own courses.

Before the End of the Period

Allow time for necessary clean-up operations. You expect to enter a clean laboratory ready for use by your section, so at the end of the period see that your own students clean up their individual working spaces and that reagent shelves and other community working areas are also clean for the next class.

Make any necessary announcements about future assignments, etc. Recheck once again, as you did before the period, special equipment and supplies; gas, water, and air outlets; lighting, etc.

Special Situations

The first and last laboratory periods of the term are not typical. During the first period the desk and its equipment are usually assigned to the student. This is the time to give general instructions concerning such matters as arrangement of the laboratory, conduct of the laboratory period, location of different types of reagents and apparatus, care of equipment and responsibility for returning things to their proper places, procedures for obtaining supplies, location and use of fire protection devices, and procedures in event of injury.

For the last period of the term it is difficult to give general directions. Procedures in different institutions vary greatly. Usually the period is spent cleaning up and returning equipment. The best suggestion which can be made here is simply that you should familiarize yourself with practice at your institution.

Other Comments

For laboratory dress, it is suggested that the instructor wear a jacket or smock or other protective garment. This may also help a student needing assistance to distinguish his instructor readily from the group.

In the laboratory, as well as in recitation, it is necessary that procedures and instructional techniques used by one group be reasonably similar to those used by others. For certain procedures, such as the balancing of oxidation-reduction equations, some instructors may stipulate that the students use specific conventions. Discussions in laboratory classes should then be in reasonable conformity with these.

Reports

Many college graduates have great difficulty in writing satisfactory concise reports of their daily work. Formal reports on laboratory experiments are therefore commonly used as a valuable form of training in undergraduate classes. These may include a statement of purpose, a description of apparatus (with sketch if needed), a concise arrangement of data obtained, calculations, and the conclusion.

Grading such reports is a task for which you will find the guidance of experienced teachers valuable. You will need to check the policy of your department and of the lecturers with whom you are working when considering how frequently such reports should be assigned and the degree of detail, neatness, and accuracy which should be required.

If a report is satisfactory in both content and arrangement, it should be accepted. If it seems desirable to discuss it with the student, the report may be marked “consult instructor” and should not be considered to be completed until after the conference. Reports should be returned promptly so that students may learn from their mistakes and improve.

An “OK” on a notebook or report may be misinterpreted by the student, since he may assume that the report is perfect. If an actual grade is not indicated, it is suggested that the instructor merely write his name or initials after the last page he has checked. Many experienced instructors feel that the practice of assigning a grade to a notebook record is impractical, except in the case of experiments with unknowns. These teachers prefer to use the notebook merely as a record for the student’s own use. Evaluation of his laboratory work is then based on suitable quizbing, results on “unknowns,” and direct personal observation of the student’s performance.

Grading

Grading laboratory work is one of the most difficult evaluations in the field of teaching. It is all too easy to use certain grades on written reports, lab quizzes, etc., as the grades for laboratory because they are numerical and easy to rank, and to forget that evaluation of actual laboratory performance is the really important factor for such grades.

Laboratory work is designed primarily to give students experience with behavior of real materials. Among the subsidiary objectives, one may include:

- To develop familiarity with basic equipment and operations.
- To develop dexterity and skill in certain laboratory techniques.
- To develop powers of observation.
- To develop the ability to interpret data and draw conclusions from observations.
- To develop the ability to plan tests or experiments to give new data as answers to specific questions.

Specific laboratory assignments and different courses may vary widely in the relative importance of these various objectives. A truly valid laboratory grade must reflect the student’s success in attaining such objectives as they apply to his course.

You should discuss these problems with your supervisor and give careful thought in advance to the particular objectives which each laboratory period should serve. Every effort should then be given to observing the actual work and performance of students in the laboratory so that you can estimate the attainment of these objectives. The student’s technique, independence, and originality should be noted since these qualities may not be reflected in written reports. Often “personal estimate” factors or brief individual comments may be included in records. These can be invaluable for personal recommendations in later years.
even though they cannot always be reflected directly in number or letter grades.

IV. Safety Measures

The chemicals and equipment used in laboratory classes are all safe if properly handled; but many of these can be dangerous if misused. Safety is, therefore, a factor of major importance in any chemical laboratory.

The general safety rules for a laboratory are similar to those that every leader should observe in the areas of his activities. They are:

Maintain high standards of laboratory housekeeping.
Observe the precautions and safety measures at known danger points in experiments.
Know where all safety or emergency equipment is located and how to use it.
Know where to call the campus health service, the hospital, or the fire department.1 Know the procedures for proper reporting of accidents.
Train yourself to be cool, composed, and efficient in event of an accident.

The last directive above is best accomplished by "thinking through" each experiment to consider possible accidents or emergencies which may arise, and checking yourself on what should be done. As the instructor in charge of a laboratory class, you must be prepared to handle emergencies promptly and efficiently.

Experience has shown that there are a number of experiments or parts of experiments which involve dangers that can be avoided with proper care. Acquaint yourself thoroughly with these aspects of the work before the start of the pertinent laboratory session with the students.

Obtain a list of safety information your students might need and post in a prominent place. Keep this up to date. Check on any special precautions regarding chemicals or equipment—for example, the proper anchoring of cylinders of gases—which should be added to your regular check-list. Keep dangerous chemicals such as potassium cyanide under surveillance and do not allow unauthorized use. Early in the laboratory, call the attention of students to safety rules such as the following and require that they be observed strictly:

Instruct students that performance of unauthorized experiments is strictly forbidden.

Emphasize the importance of keeping bench and apparatus set-ups neat and of avoiding clutter; good laboratory technique will improve results and minimize the chance of accidents.

Give the students special instructions about the use and disposal of all organic compounds and in particular of volatile, combustible liquids like carbon disulfide and ether.

Warn students that smelling of materials in the laboratory must always be done with caution, and that tasting a chemical is dangerous and may be done only in the most carefully regulated circumstances.

Point out the necessary precautions in handling electrical equipment, the need for proper grounding, etc.

Discuss with the students the value and use of safety equipment. Have the students wear safety glasses. Also use safety shields when the experiment requires it. If radioactivity experiments are performed, discuss the necessity for the use of rubber gloves and lead barriers, the procedure of personnel monitoring, the methods of decontamination, and the disposal of wastes.

Inform the students about the location of fire blankets, safety showers, and fire extinguishers, and demonstrate their use.

There are numerous special instructions about specific chemicals which should be given students. The following are some examples (but it should be emphasized that this is not a comprehensive list!):

When diluting acids, always pour the acid into the water.

In the generation of hydrogen always keep open flames away from the apparatus, wrap the generator with a towel, and test small amounts of hydrogen for purity before any large volume of the gas is collected.

Be sure the generation of chlorine is always done in the hood or by a suitable vent. Have first aid solutions available in event of an accident, and provide proper means of disposal (such as lime slurry crocks) to "kill" the generator-residues at the completion of the experiment.

Mixtures of KClO₃ with H₂SO₄, or with easily oxidized materials like carbon, phosphorus, or sulfur are very dangerous and must not be made. Contact of hot KClO₃ with rubber stoppers or corks, or with packing materials like paper or excelsior, sometimes occurs through accident or carelessness and is always dangerous.

Use a cloth towel to protect the hands when glass rods, tubing, or thermometers are being inserted or removed from rubber stoppers.

In all discussions of safety measures impress upon the students that the respect for and observation of these rules in the laboratory are a part of ordinary good citizenship. Here, as in the home, on the highways, at work or elsewhere, safety rules are not only to protect the individual himself but also his fellow men around him.

If your department requires the use of safety glasses, wear them yourself and enforce the rule impartially.

Emergency First Aid

In general, the best rule to follow with regard to any medical treatment for students who may be injured or ill is simply to get competent professional help as quickly as possible.1 However, the time necessary for this can vary markedly for different localities, different schools, and even different classes. You should, therefore, discuss carefully with your supervisor at the start of the session questions about circumstances—such as serious bleeding or burns or stopped breathing—that may require emergency treatment. Learn your professional (and even legal) responsibilities in the circumstances. Check carefully, in other words, on what to do until the doctor comes.

Sources of Safety Information

For reference in case of need, check with your supervisors and note below the names and location of books, etc., which are the best current sources of information. You will find the series of Chem Ed features on "Safety in the Chemical Laboratory," which appears monthly in the Journal of Chemical Education (starting with the January 1964 issue) to be particularly helpful.

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1 In the handbook itself, reference will be made to a table supplied inside the front cover for recording various telephone numbers for emergencies.
Tutoring

You may be asked to serve as a tutor for weak students either singly or in small groups. Tutoring any student without being paid for it is ethically acceptable, but you should not accept pay for tutoring a student who is in one of your own class or laboratory sections. You cannot take money from one of your students for giving him private lessons and still treat him exactly like everybody else when you are grading his work in class or laboratory. Refer any of your students who want to pay for private tutoring to your fellow assistants or to a departmental list of qualified individuals. Consult an appropriate officer of the Chemistry Department about proper fees if you tutor students either singly or in small groups.

When you tutor a student, do not just tell him all about chemistry—such a passive approach on his part will lead to little learning. Let your periods of working together be devoted to questions and answers based on definite assignments the student has worked on for several hours. As a tutor, you must be even more sensitive to your student’s emotional reaction to your teaching than in a recitation or laboratory session. Keep your relationship sympathetic but detached. Tutoring is valuable experience. Spend whatever time you can spare for it but do not squander time on a student who is merely too lazy to learn chemistry in the usual way. Neither you nor he will profit.

Relationships with Faculty and Fellow Graduate Students

Always bear in mind that you are a member of a teaching team. Punctual attendance at all regular or special staff meetings is expected. If you are absent or tardy, you may fail to receive important oral instructions which you need in order to serve as an effective member of the team. Chronic tardiness or absenteeism will lower the regard accorded you by both your colleagues and your superiors.

If you cannot possibly meet a scheduled class meeting at which you are the instructor in charge is inexusable unless you have made prior arrangements for someone to take your place. If you cannot possibly attend a scheduled class be sure to let the faculty member in charge of the course know of the difficulty as soon as it arises. In many universities you may not arrange for a substitute without obtaining prior approval by the person in charge of the course.

Get to know the person in charge of the course in which you are assisting. Frequent short visits with him will greatly help you to operate with maximum effectiveness as an assistant. If possible, attend the lectures for the course. If this is not possible, be sure that you understand clearly and fully what material you are to deal with and how you are to handle it in the classroom and laboratory so your work will correlate well with the lectures. There is nothing more demoralizing to a student than to be told to follow one procedure when he is in the lecture room and then to get quite different instructions in the laboratory.

Also know as many as possible of the graduate assistants—both in your course and in others. They can provide you with valuable guidance to help you get oriented to your job and your graduate studies.

Though personal initiative is a highly valued attribute of a good teacher, it is equally important that you work well with others. If you treat your colleagues, your superiors, the stockroom staff, and your
students as friends engaged in the exciting and rewarding enterprise of transmitting our chemical heritage from one generation to the next, you are well along the way to becoming a good teacher.

VI. The Art and Profession of Teaching

As a new teaching assistant, frequently just arriving on campus as a session begins, you will obviously have no opportunity to participate in any of the phases of planning, course organization, or choice of topics and experiments which go into the long-range development of courses. However, you are likely in future years to be giving serious consideration to a university or college appointment as your life work; so you should take advantage of the opportunity to learn something of the various aspects of the art and technique of the profession, above and beyond your immediate responsibilities for laboratory or discussion classes.

The first requirement for a good teacher is that he know his subject—that he have something to say to a student—but there is much to learn also about the problems of communicating with a class, especially with large classes. The truly great teachers of chemistry have undoubtedly been men who were themselves first of all outstanding in research and creative thinking; but it is unfortunately also true that many fine chemists have done a poor job of teaching for lack of attention to the simple rudiments of the art.

In the next several years you will have an unusual opportunity for reading, for practice, and for association with experienced teachers—all of which can give you a fine background for serious consideration of the profession. The brief bibliography given below may help you make a start in this. It is not in any sense a comprehensive list but is rather an introductory one.

Bibliography

As background in the philosophy of science and of chemistry, try:


For the aims and philosophy of education, read:


For some of the more controversial aspects of education and of teacher training, read:


For a more specific approach to science teaching:


Articles dealing with various teaching problems appear regularly in the JOURNAL OF CHEMICAL EDUCATION. These include a special series on "Textbook Errors" (since 1955) and a new series (which began in 1964) of special Resource Papers written particularly as a service to teachers.

Teaching Aids

The "age of science" has brought with it a wide variety of ideas and instrumentation to aid teachers in presentation of topics. These may include elaborate teaching machines, films, filmstrips, paperback books and other supplementary reading, demonstrations, "visuals," models, and others. You should watch for opportunities to observe the use of some of these.

Here again, scanning and reading the JOURNAL OF CHEMICAL EDUCATION can be very helpful. There are regular features on such topics as ideas for demonstrations for overhead projection (the Tested Overhead Projection Series), ideas for new demonstration experiments (the Tested Demonstration Series), and chemical instrumentation, plus short essays on important discoveries and a wide range of individual articles on such topics.

It is worthwhile to examine sometime the materials developed recently for the Chemical Bond Approach and Chemical Education Materials Study programs for high school. These exemplify clearly the results of careful planning to use textbook, laboratory manual, supplementary guides for teachers or students, demonstrations, films, etc. in a carefully coordinated plan to help the teacher in his work.

VII. Concluding Remarks

For your own personal development the following points cannot be overemphasized:

(1) Teaching is a vital profession and a fascinating experience. Though one may be well trained with respect to knowledge of subject matter, only after working with classes for several semesters can one attain the desirable poise and demeanor which characterize our "good teachers."

(2) Many of our most experienced teachers will state that each time they present a topic they learn more about it. An old axiom often quoted is: If you really want to learn a subject, teach it.

Your basic purpose as a teaching assistant is to try to stir a student's interest in chemistry and to help him understand the science. The ideas and suggestions presented in the preceding pages constitute an attempt to help you as an assistant to fulfill this purpose in your own work. They furnish advice on certain matters with which you are likely to be unfamiliar. Two items in this advice are paramount in importance: (1) cooperate in the policies and basic plan for the particular course with which you work; and (2) seek the advice and counsel of experienced teachers.

It is our sincere hope that the suggestions given in the preceding sections will aid in guiding you as an inexperienced teacher to the level of sound experience that will bring you the deep satisfaction which can come from a good job well done.