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ABSTRACT

Project Chemlab was designed to prepare an "Annotated List of Laboratory Experiments in Chemistry from the Journal of Chemical Education (1957-1979)" and to develop a computer file and program to search for specific types of experiments. Provided in this document are listings (photoreduced copies of printouts) of over 1500 entries classified into seven major fields of chemistry and arranged alphabetically by author within each field. These fields include: analytical chemistry, biochemistry, inorganic chemistry, physical chemistry, polymer chemistry, and radiochemistry. Each entry contains a field code, a keyword code (to facilitate visual scanning of the lists and for use in searching the computer file), a code indicating background required, and the nature of the experiment. In addition, special requirements/hazards and time commitment are noted when applicable. The introduction to the listings contains definitions of keywords used and an explanation for the background requirement codes. The overall document consists of a 3-page summary of the project (including information on how the lists were produced), 12 pages of appendices consisting of copies of four project newsletters (two of these newsletters contain instructions for accessing and searching the computer file on the Rensselaer Polytechnic Institute (RPI) computer by dial-up modem), and 360 pages of appendices consisting of the list of experiments. (JN)

NSF/SED-82030

Final Report

National Science Foundation Grant SED79-23685

ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS WITH COMPUTER ACCESS

Introduction

The objectives stated in the proposal were:

(1) The preparation of an annotated list of student laboratory experiments from the Journal of Chemical Education, containing authors, title, reference, field of chemistry, type of work, special requirements and hazards, time commitment, and background required.

(2) The development of a COMPUTER FILE and program for access (searching for specific types of experiments).

The stated objectives have been met, and the materials so prepared have been widely distributed on a cost basis.

Preliminary Lists

Project personnel abstracted articles from the Journal of Chemical Education and prepared a Preliminary List in September, 1980. This list was available in the form of a computer printout, classified into principal fields, and alphabetized by first author. Originally containing about 800 entries, it was supplemented by two additional lists in December 1980.

The format for printout was determined by user response to a questionnaire, and a search program was developed at the same time, with the help of user comments.

Revised Lists

Revised Lists were prepared, which covered 90% of the pertinent articles in the years 1957-1979. These were made available in September 1982 as a computer

laser print which was photoreduced. This list also was organized by principal field (analytical, biochemistry, inorganic, organic, physical, polymer and radiochemistry). It contained nearly 1500 entries; our estimate in the proposal was 1000. After the formal expiration of the grant, a "Corrections" file and an "Additions" file (about 150 entries) was added. A copy of these three lists is included in the Appendix. The distribution in the United States and Canada has been about 180 copies by order (at cost) and 20 to others. The overseas distribution is about 40.

Advisory Committee

Besides the project personnel, a group of volunteer workers at other institutions - the Advisory Committee - has assisted in reviewing entries, making policy decisions, and editing.

Newsletters

Four Newsletters have been mailed to correspondents - the fourth in June 1983, after the expiration date of the grant. Copies are included in the Appendix.

Computer Access

The search programs developed by project personnel at RPI have functioned very well. RPI students have used them routinely for several years. They were demonstrated at an NSF Project Directors meeting and described in the Newsletters and at several national and regional meetings on Chemical Education. One college library is using the files in this way.

Microcomputer Use

Although not specifically mentioned in the proposal, transfer of the files to microcomputer was a goal which we have not yet realized. Project Seraphim

(NSF supported) will assist in this part of the work in Summer, 1983.

Availability of Materials and Continuance of the Project

The materials developed under the grant have been made available at cost to those requesting. To be of continuing utility these files will require updating, and therefore a continuing Project CHEMLAB. Support has been requested from the American Chemical Society Division of Chemical Education, and the group of project personnel and other volunteer workers (no salaries have been paid by the project recently) is abstracting current volumes (1980-1983) of the Journal of Chemical Education. We will make these available as supplements without additional cost, if our request to the American Chemical Society for modest support is granted.

APPENDIX

PROJECT CHEMLAB

Department of Chemistry
Rensselaer Polytechnic
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Troy, New York 12181

Department of Chemistry
State University of New York
at Stony Brook
Stony Brook, New York 11794

January 1981

Newsletter of the National Science Foundation Project

ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS WITH COMPUTER ACCESS

The announcement in the Journal of Chemical Education (Vol. 57, Number 5, May, 1980) of the preparation of an ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS PUBLISHED IN THE JOURNAL OF CHEMICAL EDUCATION nearly coincided with the award of an NSF Grant (SED 79-23685) in June, 1980, which included special emphasis on computer access (Technology as applied to learning) to the annotated list.

This newsletter is addressed to all who have made inquiry or requested the preliminary lists. The lists which were mailed in summer and fall 1980 in response to requests (nearly 100) were separate lists, classified as Analytical, Biochemistry, Inorganic, Organic, Physical, Polymer, and Radiochemistry. The organic lists were in an older format with less annotation, and all lists were incomplete (approximately 60% coverage), and had some errors. The legibility of some entries was marginal. We must apologize for these problems, but reassure you that they will be replaced by the updated lists in the form of a computer printout as soon as that is available, without additional cost.

The updating process has produced (December, 1980) two additions to the preliminary list, Add 76 and Add 77-79, not subdivided as were the preliminary lists. More are underway. The keywords for searching, ChemVoc, have been modified and extended a little, in obvious ways. We will not mail those things to you unless someone has immediate need, but instead will use them in the next step of the project, the creation of the data base in the form of a computer file.

The programs are written in PL/1, and are accessed through our operating system, MTS (Michigan Terminal System). Programs for listing, correcting, and printing are operative. Programs for alphabetizing, searching by keyword or combination of keywords, and by level are ready now, and other ways of searching are planned. We will give more details concerning search programs and methods for computer interaction in a later newsletter.

Meanwhile, we want to focus attention on the nature of the annotations and the ChemVoc or keyword method of searching which we have used in the preliminary lists. The objective, to develop these in the most useful form will be met only if we have interaction with the users. We have enclosed a questionnare, directed to these points, to which we urge that you respond promptly. Even if you have not yet made use of these lists, please examine them now and let us have your impressions.

SIINC

An NSF grant supports a "Scientific Instrumentation Information Network and Curricula" project at the Department of Chemistry, Virginia Military Institute, Lexington, VA 24450. Professor Frank A. Settle, Jr. is Director. Its focus is a computer based information system for dissemination of information to users of chemical instrumentation. At present, a module on gas chromatography illustrates the nature and scope of the work planned. We have been in correspondence to try to co-ordinate work where there are common elements.

PERSONNEL

Stanley Bunce, Professor of Chemistry, Rensselaer Polytechnic Institute, Director, is the person who is slow in replying to correspondence, but appreciates recieving it nonetheless.

Carolyn B. Allen, General Chemistry Laboratory Co-ordinator, State University of New York, Stony Brook, who has done more searching the files of J. Chem. Educ., annotating, and typing than all others on the project by a large factor.

James W. Zubrick, Chemistry Laboratory Demonstrator, Rensselaer Polytechnic Institute, who has alone created the programs, and who tells us how to edit, interface, and format.

Wolfgang Segmuller, Undergraduate Assistant who is transcribing typed data into the computer file.

And others who have helped with typing, suggestions and encouragement.

NEXT TIME

Description of programs, discussion of possible means of access.

For information or suggestions, write or phone:

Professor Stanley C. Bunce
Department of Chemistry
Rensselaer Polytechnic Institute
Troy, New York 12181
(518)-270-6355

This NEWSLETTER was prepared and processed using TEXTFORM, an MTS word processing program.

PROJECT CHEMLAB

Department of Chemistry
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Stony Brook, New York 11794

July 1981

Newsletter of the National Science Foundation Project

ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS WITH COMPUTER ACCESS

Project CHEMLAB originated at R.P.I. five years ago and was announced in the Journal of Chemical Education 57#15, 379 (1980). It is supported in part by NSF Grant SED 79-23685. The purpose of this project is to provide the scientific community with a file of laboratory experiments published in the Journal of Chemical Education in an easy-to-read and easy-to-search form. Each entry in the file gives the correct literature reference and a very brief description of the contents of the article. Preliminary lists of experiments, classified as Analytical, Biochemistry, Inorganic, Organic, Physical, Polymer, and Radiochemistry were made available in Summer, 1980. They were supplemented by two lists, ADD-77-79 and ADD-76 in December, 1980. Newsletter #1 is still available, and gives more details on these matters. Eventually, all the experiments ever published in J. Chem. Education will be referenced in the CHEMLAB file, which will be computer-searchable.

REVISED LISTS

The timetable for preparing revised lists, complete thru 1980, first set for Summer, 1981, has been extended to late fall. The revised lists will be classified by principle field as were the preliminary lists, but they will use a more sophisticated classification, contain much more annotation, and will use a revised and extended set of FLAGWORDS. (A FLAGWORD is a word in the CHEMVOC language. It describes the contents of the article in a way which can be understood either by the computer or a scientist searching the file. Earlier we called them "keywords" or "descriptors".) Copies of the revised list will be mailed to all who requested copies of the preliminary lists, and announced in a second article in the Journal of Chemical Education.

FORMAT

A questionnaire was mailed to all who had received copies of the preliminary lists in February 1981. The response was unusually good, 38/62 from the United States and Canada, and 5/14

from overseas. More than half of the replies had detailed suggestions and many had encouraging comments, including offers of assistance. The results showed a clear preference for Format B subsequently modified in spacing and capitalization), and general approval of scope, annotations, additional notes on hazards and special equipment, and other details. The key element of the system, coding by FLAGWORDS, received the most favorable comment. Many users made helpful comments.

ADVISORY COMMITTEES

We would like to formalize some of the user input by forming two advisory committees, one concerned with the scope and methods of the project - including such matters as vocabulary, format, abbreviations, sources, etc. (for example, should we include the "A" pages of the Journal?); and the other concerned with the telephone access to the data base and search program at RPI from remote terminals, and with data base and search program transfer to another computer. Volunteers are needed for both advisory committees: please write or phone (518+270-6355) Stanley Bunce at RPI.

COMPUTER ACCESS

We now have programs up for searching by FLAGWORD and by author, and have made some progress on computer access for off-campus users.

USE

About 100 copies of the Preliminary List have been mailed in response to requests. These have been used for a variety of projects: searching for high school chemistry demonstrations, reviewing analytical chemistry experiments by two textbook authors, helping set up new laboratory programs and in course revisions in physical, analytical, inorganic and general chemistry, and for student projects.

It has been of help in at least two aspects of the work on SIINC, the "Scientific Instrumentation Information Network and Curricula" project at the Department of Chemistry, Virginia Military Institute, Lexington, VA 24050. Professor Frank Settle is the director of this program.

MEETINGS

We will be demonstrating and talking about Project CHEMLAB at the International Conference on Chemical Education at the University of Maryland, August 10-14, at the ACS National Meeting in New York on August 28th, and at the ACS Regional Meeting in Rochester, October 18-21.

PERSONNEL

Stanley Bunce, Professor of Chemistry, Rensselaer Polytechnic Institute, Director.
Carolyn B. Allen, General Chemistry Laboratory Co-ordinator, State University of New York, Stony Brook.
James W. Zubrick, Chemistry Laboratory Demonstrator, Rensselaer Polytechnic Institute.
And others who have helped with typing, suggestions and encouragement.

For information or suggestions, write or phone:

Professor Stanley C. Bunce
Department of Chemistry
Rensselaer Polytechnic Institute
Troy, New York 12181
(518)-270-6355

This NEWSLETTER was prepared and processed using TEXTFORM, an MTS word processing program.

PROJECT CHEMLAB

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State University of New York
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Newsletter 3
National Science Foundation Project

ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS WITH COMPUTER ACCESS

Project CHEMLAB originated at R.P.I. six years ago and was announced in the Journal of Chemical Education 57, 379(1980). It is supported in part by NSF Grant SED 79-23685. The purpose of this project is to provide the scientific community with a file of laboratory experiments published in the Journal of Chemical Education in an easy-to-read and easy-to-search form. Each entry in the file gives the correct literature reference and a very brief, critical description of the contents of the article. Preliminary Lists of experiments were made available in Summer, 1980, and supplemented by additional lists in December, 1980. Eventually, all the experiments ever published in the Journal will be referenced in the CHEMLAB file, which is computer-searchable.

REVISED LISTS - 1956-1979

The revised list of experiments, 1957-1979 inclusive, is now available as a computer printout, and for computer search. The list has been checked for accuracy by seven reviewers on the Advisory Committee. It has not yet been checked to find if all appropriate articles have been included. This will be done in the next few months and a supplementary list issued if it is needed. There are approximately 1600 entries.

COMPUTER PRINTOUT

For this purpose, the files are organized and printed by *PRINCIPAL FIELD (ANALYtical, BIOCHEMistry, INORGanic, ORGanic, PHYSical, POLYMER, RADIOCHEMistry,), arranged alphabetically within each field. A sample of the new format is:

*ANAL ORG CONSUMERPROD NOPROC PROJ 4
Quantitative Laboratory Experiments Based on Reactions of Cyclamates
Barnes, R.M.
J. Chem. Educ. 49,272(1972)
Detailed presentation of student results. See especially for novel use of nitrates and nitrous acid. Methods include gc, ir, uvis, electroanal.

*ANAL PHYS CATALYSIS CLOCK KIN 2
Catalytic Determination of Trace Copper
Bartis, J.T.; Wiesenfeld, J.R.
J. Chem. Educ. 53,666(1976)
The well known Cu^{++} catalysis of the peroxydisulfate oxidation of iodide is adapted to the determination of trace copper. Calibration curve construction.

This computer printout together with a KEYWORD glossary will be sent to all who purchased or received copies of the Preliminary Lists; there will be no additional charge. Those who requested copies after the supply of the Preliminary Lists was exhausted will also be sent the Revised List, together with an invoice. For those who wish now to order a set the cost for photoreduced copy is $10, including printing, paper and postage for U.S.A. and Canada. Requests should be by letter to S.C. Bunce, Department of Chemistry. At your option, they may be prepaid by check or by purchase order.

ACCESS TO COMPUTER FILE AT RPI

It is possible to access and to search the file of experiments on the RPI computer by dial-up modem. The files may be displayed directly on your local device, or they may be printed at RPI, with the printout mailed to a stated address.

A sample of the search procedure will be available without cost via dial-up modem.

In response, a message will inform you of procedures for a very limited (first five entries) search. The glossary of KEYWORDS accompanying this newsletter should be helpful in a search by KEYWORD or combinations of keywords. It may also be possible to search by NAME of author. Messages from the computer program will detail what will be available and when. For exact dial-up procedures, see the section "Calling up CHEMLAB" later in this NEWSLETTER.

For more extensive searching from a remote terminal, we will issue a unique password to each person who requests it, either by telephone or by letter (to S.C. Bunce or J.W. Zubrick). Charges will be dependent on the services requested and the computer time used, but they will not be large unless a large amount of printout for mailing is requested to be done quickly.

TRANSFER OF FILES

We invite inquires from those interested in transfer of the computer files and search programs by tape to other main-frame computers.

We have had many requests for transfer to microcomputer floppy disks. We are prepared to do this, <u>if</u> there is sufficient interest. But we must have <u>responses</u> from those interested, giving the suggestions for the (one or two) kinds of

microcomputer that might first be used. Please note that we do not have ready access to different micros, that the data base is rather large (estimates are from 8 to 10 single-sided single density disks), and that it may be up to the requester to write a searching program.

ADVISORY COMMITTEE

The present revised files have all been edited by the following Advisory Committee members:
David Todd, Worcester Polytechnic Institute (MA) - all, for style and errors
Robert Merrer, Western Connecticut State College - *ANAL
Paul Laur·n, Suffolk Community College (NY) - *BIOCHEM + *POLYMER
Van Crawford, Mercer University (GA) - *INORG (Gen)
Edward Matjeka, Boise State University (ID) - *ORG
Manit Rujimethabis, Lakehead University (ON) - *PHYS
Morris Bader, Moravian College (PA) - *RADIOCHEM

We invite anyone interested to function as an Advisory Committee member. The following specific tasks need addressing:

1. Transfer to microcomputers including data base storage format, efficient, user-friendly search programs, and system selection (which micros, disk size, common formats, etc. ?).

2. Abstracting 1980, 1981, 1950-56 (about 150 articles), 1946-49 (about 80 articles) and 1924-48 (? articles). We have the preliminaries done on all except 1924-48. One need not undertake to abstract all in 1980, for example, but could do only those he/she feels comfortable with.

3. A page check of each volume 1957-1979 (one year at a time - or perhaps one or two years per person) vs an alphabetical author list from the main file, which we can supply.

4. Encouraging us! This is much work.

NEXT STEPS

These are implicit in the first three tasks specified for Advisory Committee. We have missed so many deadlines that we are reluctant to put tentative dates for any of these. However, we do intend to finish the project and to keep it current and usable. The National Science Foundation Grant funds are exhausted; suggestions for sustaining the operation financially are needed.

CALLING UP CHEMLAB

To access the files at RPI, you will need at least a modem and a terminal of some type. If you have never used a modem/terminal setup, please see your local computing center, or computer store for details.

To get on the system:

1. Dial (518) 270-6603 for a 300bps line OR dial (518) 270-6696 for a 1200 baud, Vadc 3400, AJ1234; OR dial (518) 270-6698 for a 1200 baud, Bell 212A.

2. Once connected, type the word GO, and press the RETURN key or ENTER key. A colon(:) should appear on the screen.

3. Press the RETURN key AGAIN. Several messages and/or questions may be displayed. Please ignore them. Wait for a number sign (#) to appear at the extreme left of the screen.

4. Type the line SIGbBAMFbS (the lowercase b stands for a space) press RETURN

5. A field of characters will be sent. This is to obliterate your password if you're at a printing terminal. It has no meaning at a CRT terminal.

6. Type the password SCAN and press the RETURN key.

7. You should now be on the system. Follow the directions and do not forget to press the RETURN key at the end of each line.

8. If there are any problems, please call or write James W. Zubrick (518) 270-6786. Include the printout with any errors if you write.

PERSONNEL

Stanley C. Bunce, Professor of Chemistry, Rensselaer Polytechnic Institute, Director.
Carolyn B. Allen, General Chemistry Laboratory Co-ordinator, State University of New York, Stony Brook.
James W. Zubrick, Chemistry Laboratory Demonstrator, Rensselaer Polytechnic Institute.
And others who have helped with typing, suggestions and encouragement.

For more information or suggestions, write or phone:

Stan Bunce (518)270-6355 or Jim Zubrick (518)2706786 (especially with respect to computer files etc.)
Department of Chemistry Rensselaer Polytechnic Institute Troy, New York 12181

Carolyn Allen (516) 246-7662, Department of Chemistry, SUNY Stony Brook, Stony Brook, NY 11794

PROJECT CHEMLAB

Department of Chemistry
Rensselaer Polytechnic Institute
Institute
Troy, New York 12181

Department of Chemistry
State University of New York
at Stony Brook
Stony Brook, New York 11794

June 1, 1983

Newsletter #4

ANNOTATED LIST OF CHEMISTRY LABORATORY EXPERIMENTS WITH COMPUTER ACCESS

Project CHEMLAB originated at R.P.I. six years ago and was announced in the Journal of Chemical Education 57, 379 (1980). It was earlier supported in part by NSF Grant SED 79-23685. The purpose of this project is to provide the scientific community with a file of laboratory experiments published in the Journal of Chemical Education in an easy-to-read and easy-to-search form. Each entry in the file gives the correct literature reference and a very brief, critical description of the contents of the article. Eventually, all the experiments ever published in the Journal will be referenced in the CHEMLAB file, which is computer-searchable.

Preliminary lists of experiments were made available in Summer, 1980, and supplemented by additional lists in December, 1980. The REVISED LIST OF EXPERIMENTS, 1957-1979 inclusive, was made available as a computer printout and for computer search in September, 1982. The list was checked for accuracy by seven reviewers on the Advisory Committee. It is still available as a computer printout and in photoreduced form from a laser printer.

For this purpose, the files are organized and printed by *PRINCIPAL FIELD (ANALytical, BIOCHEMistry, INORGanic, ORGanic, PHYSical, POLYMER, RADIOCHEMistry), arranged alphabetically within each field. A KEYWORD glossary is included.

For those who wish now to order a set the cost for photoreduced copy is $10, including printing, paper and postage for U.S.A. and Canada. Requests should be by letter to S.C. Bunce, Department of Chemistry. At your option, they may be prepaid by check or by purchase order.

CORRECTIONS AND ADDITIONS TO 1957-1979 REVISED LISTS

The two lists, CORRECTIONS, and ADDITIONS are now available and are being sent to all who received copies of the ANNOTATED LIST. Both lists are in the photoreduced format, which seems to be easier to use and is less costly to mail. There is no additional charge for these. The total number of entries for

1957-1979 is approximately 1700..

MICROCOMPUTER FORM

Help from Project Seraphim and from RPI Copmputer Services is imminent. We plan to work on transfer of the data base and search programs to diskettes in Summer 1983, probably first for use with the IBM PC. Comments or suggestions from those interested to use a microcomputer for storage and searching would be welcome.

ADVISORY COMMITTEE

The ADDITIONS files has been edited by the following Advisory Committee members:

Robert Merrer, Western Connecticut State College - *ANAL
Van Crawford, Mercer University (GA) - *INORG (Gen)
Edward Matjeka, Boise State University (ID) - *ORG
Manit Rajimethabis, Lakehead University (ON) - *PHYS

We invite anyone interested to function as an Advisory Committee member. The following specific tasks need addressing:

1. Abstracting 1980, 1981, 1982, 1950-56 (about 150 articles), 1946-49 (about 80 articles) and 1924-46 (? articles). We have the preliminaries done on all except 1924-46. One need not undertake to abstract all in the 1982 volumes, for example, but could do only those he/she feels comfortable with.

2. Editing new entries in Biochemistry, Polymer, Radiochemistry (checking abstracts for accuracy, selection of KEYWORDS, etc.).

ACCESS TO COMPUTER FILE AT RPI

It is possible to access and to search the file of experiments on the RPI computer by dial-up modem. The files may be displayed directly on your local device, or they may be printed at RPI, with the printout mailed to a stated address.

A sample of the search procedure is available without cost via dial-up modem; see CALLING UP CHEMLAB.

For more extensive search from a remote terminal, we will issue a unique password to each person who requests it, either by telephone or by letter (to S.C. Bunce or J.W. Zubrick). Charges will be dependent on the services requested and the computer time used, but they will not be large unless a large amount of printout for mailing is requested to be done quickly.

CALLING UP CHEMLAB

To access the files at RPI, for a sample search, without charge, you will need at least a modem and a terminal of some type. If you have never used a modem/terminal setup, please see your local computing center or computer store for details.

To get on the system:

1. Dial (518) 270-6603 (or 266-6603) * for a 300bps line On dial (518) 270-6636 (or 266-6636) for a 1200 baud, Vadc 3400, AJ1234; OR dial (518) 266-6638 for a 1200 baud, Bell 212A.

2. Once connected, type the word GO, and press the RETURN key or ENTER key. A colon (:) should appear on the screen.

3. Press the RETURN key AGAIN. Several messages and/or questions may be displayed. Please ignore them. Wait for a number sign (#) to appear at the extreme left of the screen.

4. Type the line SIG AMCR S and press RETURN.

5. A field of characters will be sent. This is to obliterate your password if you're at a printing terminal. It has no meaning at a CRT terminal.

6. Type the password SCAN and press the RETURN key.

7. You should now be on the system. Follow the directions and do not forget to press the RETURN key at the end of each line.

8. If there are any problems, please call or write James W. Zubrick (518) 270-6786 (or 266-6786). Include the printout with any errors if you write.

PERSONNEL

Stanley C. Bunce, Professor of Chemistry, Rensselaer Polytechnic Institute, Director.
Carolyn B. Allen, General Chemistry Laboratory Co-ordinator, State University of New York, Stony Brook
James W. Zubrick, Chemistry Laboratory Demonstrator, Rensselaer Polytechnic Instute.
Kenneth Ng, work study student at RPI (who is largely responsible for the "corrections"
And others who have helped with typing, suggestions and encouragement.

For more information or suggestions, write or phone:

Stan Bunce, (518) 270-6355 (or 266-6355) or Jim Zubrick, (518) 270-6768 (or 266-6786) especially with respect to computer files etc.).
Department of Chemistry, Rensselaer Polytechnic Institute, Troy, NY 12181

Carolyn Allen, (516) 246-7662, Department of Chemistry, SUNY, Stony Brook, Stony Brook, NY 11794.

*RPI will undergo a phone change about 7/1/83.

ANNOTATED LIST OF LABORATORY EXPERIMENTS IN CHEMISTRY FROM THE JOURNAL OF CHEMICAL EDUCATION

PROJECT CHEMLAB

Revised Lists, 1957-1979

supported in part by NSF Grant SED79-23685

S.C. Bunce, Dir.
J.W. Zubrick
C.B. Allen (State University of New York, Stony Brook)

August, 1982

Department of Chemistry
Rensselaer Polytechnic Institute
Troy, NY 12181

These lists are photoreduced copies of computer printout. All entries describing laboratory experiments in Chemistry in the Journal of Chemical Education 1957-1979 inclusive were screened and annotated.

The list has been edited by the following Advisory Committee members:

Morris Bader, Moravian College (PA)
Van H. Crawford, Mercer University (GA)
Paul M. Lauren Suffolk County Community College (NY)
Edward R. Matjeka, Boise State University (ID)
Robert J. Merrer, Western Connecticut State College (CT)
Manit Rujimethabhas, Lakehead University (ONT)
David Todd, Worcester Polytechnic Institute (MA)

For this format, the computer file has been organized by seven principal fields:

*ANAL	Analytical Chemistry
*BIOCHEM	Biochemistry
*INORG	Inorganic Chemistry
*ORG	Organic Chemistry
*PHYS	Physical Chemistry
*POLYMER	Polymer Chemistry
*RADIOCHEM	Radiochemistry

The level of the work is indicated as follows:

0 Requires no background in chemistry.
1 Appropriate for high school science or chemistry.
2 For general chemistry students.
3 For advanced first year and middle level undergraduate courses.
4 For advanced undergraduate or first year graduate courses.
5 For advanced graduate and specialized.

Additional KEYWORDS are used, as described in the accompanying Glossary to facilitate quick visual scanning of this list, as well as searching the computer file.

For additional information, please write to:

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Rensselaer Polytechnic Institute
Troy, NY 12181

C.B. Allen
Department of Chemistry
SUNY Stony Brook
Stony Brook, NY

or

J.W. Zubrick (especially for computer use)
Department of Chemistry
Rensselaer Polytechnic Institute
Troy, NY 12181

KEYWORD GLOSSARY

Keyword	Definition
AA	atomic absorption spectroscopy
ACBA	acid-base titration; acid-base reactions, theory
ADDITION	an addition reaction
AFFC	affinity chromatography
ANAL	analytical chemistry, measurements
APPARATUS	a new apparatus
ASPIRIN	the Aspirin experiment. Preparation, properties or analysis of aspirin
ASSOC	association on the atomic-molecular level, incl. intermolecular H-bonding
AUTORAD	autoradiography
AVOGADRO	det'n or calculation of Avogadro's number
BACTERIA	bacterial preparations, microbial preparations
BIOCHEM	biochemistry, biochemical techniques
CALORIMETRY	calorimetry. See also HEAT, THERMO.
CARBENE	carbene reaction.
CATAL	catalysis, preparation, properties of catalysts
(CATALYSIS)	See CATAL
(CATALYST)	See CATAL
CHARGETRANS	charge transfer reactions
CHIRAL	stereoisomers which have chiral properties; optical isomers. See also GEOM.
CHROMATOG	any kind of chromatograpy except AFFC, COLUMNC, GELC, HPLC, PAPERC, and TLC, which are indexed separately.
CLATH	clathrates, inclusion complexes
CLOCK	a clock reaction
COLLIG	colligative properties, except VAPORPRESS and CRYO, which are indexed separately.
COLLOID	colloidal state; prep'n, properties of colloids
COLOR	color; color-producing reactions; color-centers, dyes and dying; color photography. Colorimetric mthds, see COLORIM and UVIS (spectroscopy).
COLORIMETRY	colorimetry. See also UVIS.
COLUMNC	column chromatography
COMPLEX	complex compounds other than inclusion compounds (see CLATH) and coordination compounds of 1st row trans. metals (COORD).
COMPLEXIM	complexim etric methods. EDTA tit'ns are indexed under EDTA. See UVIS for spectroscopic mthds.
COMPUTER	applications of the computer in chemistry.
(CONFORM)	see GEOM.
CONSUMERPROD	chemistry of consumer materials.
COORD	coordination compounds, coord'n polyhedra, especially first-row trans. metals. See also COMPLEX
CORROSION	corrosion chemistry
COURSE	a course of instruction. See also PROJ, INTEGR.

CRYO	cryogenics; freezing-point msmnt; low temperature
CRYSTAL	crystalline state, crystal structure. For recrystallization, see SEPARATION
CYCLOADDITION	a cycloaddition reaction
DECAY	det'n of decay constant or half-life
DEMO	expt intended as a demo. Demonstration expts are indexed under the appropriate area keyword.
DENSITY	density measurements, density gradients. Optical dens., etc, not indexed under this keyword.
DIALYSIS	dialysis. See also MEMBRANE.
DIELS ALDER	a Diels Alder reaction. See also CYCLOADDITION.
DIFFUSION	the transport property. Diffusion in any state.
DIPOLE	dipole structure, dipole moments, etc.
DISTRIB	solvent extraction, distribution between two (or more) phases, incl. counter current.
(DNA)	see NUCL ACID
DRYLAB	a simulated experiment
DTA	differential thermal analysis, and similar techniques such as TGA, wt. loss on drying, etc.
(DYES)	see COLOR
(ECOLOGY)	see ENVIRON
EDTA	EDTA titration, EDTA properties, etc.
ELECTROANAL	electroanalytical measurements, e.g. coulometry, potentiometry, polarography. See also PH.
ELECTROCHEM	electrochemistry; electrochem techniques other than those indexed under ELECTROANAL.
ELECTRODE	preparation and/or use of any electrode except ion-selective electrodes. See IONSELECT.
ELECTROPHOR	electrophoresis, gel electrophoresis
ENVIRON	environmental chemistry
ENZYME	enzymes; enzyme kinetics
ERROR	error analysis. See also STATISTICS. Errors in articles are indexed with the keyword MISTAKE.
ESR	electron spin resonance
EXCHANGE	exchange reactions, exchange rates
EXOBIO	chemical evolution; Miller exp'nt; exobiogenesis
EXPLOSION	An experiment which involves a legitimate explosion reaction, thus a hazard. For pyrotechnics, see MAGIC.
(EXTRACTION)	see DISTRIB
FASTREACTION	a fast reaction
FLASHPHOTOL	flash photolysis
FLUOR	fluorescence, fluorimetry.
FORENSIC	forensic chemistry
FREERAD	a free radical reaction or mechanism
FRIEDEL CRAFTS	a Friedel-Crafts reaction
FUEL CELL	use or construction of a fuel cell
GAS	gaseous state, gas law experiments, gas constant
GC	gas chromatography; gas-liquid chromatography, etc. HPLC is indexed separately.
GELC	gel chromatography
(GEL ELECTROPHORESIS)	see ELECTROPHOR
GEOM	geometric stereoisomers incl. conformers
GLASS	glass chemistry; glassy state; glass formation
GLOVEB	glovebag; glovebox; preparations that require an inert atmosphere.
GRAVIM	gravimetry; analytical balance
GRIGNARD	a Grignard reaction
(HALF-LIFE)	see DECAY
HANDICAPPED	designed for handicapped students
HAZARD	warning keyword. A hazard is involved that may or may not be highlighted in the article. All uses of this keyword explained in the abstracts.
HEAT	thermometry. Calorimetry and thermodynamics are indexed separately. See THERMO.
HETEROCYCLIC	heterocyclic chemistry
HISTORIC	repeats or modernizes a historic experiment.
HITEMP	high temperature techniques. This keyword should be taken as a warning that special hazards are involved and suitable precautions taken.
HPLC	high performance liquid chromatography; high performance reversed phase chromatogr., etc.
HPRESS	high pressure. WARNING: High pressure techniques involve hazards.
(HYDROLYSIS)	listed w. ACBA, KEQ
INORG	inorganic chemistry, techniques, materials
INSTR	an experiment for an instrumental analysis course
INTEGR	an integrated course of experimental work involving more than one field of chemistry
IONSELECT	ion-selective electrodes, includes the glass electrode
IONX	ion-exchange techniques, materials
(INERT ATM)	see GLOVEB
IR	infra red spectroscopy, radiation
ISOMERS	structural isomers, isomerization. For stereoisomers, see CHIRAL or GEOM. Nuclear isomers are indexed under DECAY.
ISOTOPE	isotope effects; isotope dilution analysis
KEQ	equilibrium constant; formation constants, etc. Solubility product is indexed separately.
KIN	kinetics; rate of reaction
KSP	solubility product constant; see also SOLUB
LASER	lasers, techniques & materials
LIQUID	liquid state; liquid structure
LUMIN	luminescence; luminescence spectra
MACROCYCLE	macrocyclic cmpds or complexes; crown ethers
MAGIC	magic shows; fireworks
MAGNETIC	magnetism; Gouy balance. NMR, PMR indexed separately
MASSPEC	mass spectroscopy
MEMBRANE	preparation and properties of membranes; see also IONSELECT
MICELLE	formation & properties of micelles
MICROSCOPE	microscope; polarizing microscope
MISTAKE	calls attention to a serious error in an article, always explained in the abstract.
(MOLAR VOL)	see DENSITY
MOL.SPECT	molecular spectroscopy except IR, UVIS

MOLTENSALT	molten salt chemistry; techniques
NAME	a named reaction other than FRIEDEL.CRAFTS, DIELS. ALDER or GRIGNARD indexed separately
NATPROD	chemistry of natural products
NEUTRON	neutrons; neutron irradiation analysis
NMR	NMR and similar techniques (as PMR)
NONAQ	non-aqueous chemistry; non-aqueous titration
NOPROC	"no procedure" The experiment is described in some other fashion than the step by-step recipes used in lab manuals.
NUCL.ACID	nucleic acids incl. RNA, DNA.
OPTICAL	optics, optical instruments; overhead projector; cameras; TV sets. See also MICROSCOPE. Optical isomers are indexed as CHIRAL.
ORD	optical rotary dispersion
ORG	organic chemistry, materials & techniques
ORGANOMETAL	organometallics. Bioinorganics are accessed by calling BIO and INORG.
OSC.RXN	oscillating reaction
OSMOSIS	osmosis, osmometry
PAPERC	paper chromatography
PESTICIDES	pesticides
PH	pH chemistry; pH titrations; indicators
PHARM	pharmacological chemistry; pharmaceuticals
PHASE	phase diagrams; multiphase systems
PHEROMONES	pheromones
PHOSPHOR	phosphorescence; phosphors
PHOTO	chemistry of light; photolysis. FLASHPHOTOL is indexed separately. See also OPTICAL, LUMIN FLUOR, PHOSPHOR
PHOTORES	photoresist
PHYS	physical chemistry
(PMR)	see NMR
POLARIM	polarimetry
POLYMER	polymer chemistry; polymeric materials incl. oligomers
PORPHYRIN	chemistry of porphyrins and related substances
PREP	an inorganic, organic or biochemical preparation
PROJ	an experiment or set of experiments designed as or suitable for a class or individual project.
PROOF	a proof-of-structure experiment
PTC	phase transfer catalysis
(PYROTECHNICS)	See MAGIC, EXPLOSION.
QUAL	qualitative analysis
QUANT	quantitative techniques
QUANTUM	quantum mechanics; advanced spectroscopy
RADIOCHEM	radiochemistry; radiochemical techniques
RAMAN	Raman spectroscopy
REARRANGE	a rearrangement reaction
REDOX	reduction; oxidation; oxidation-reduction
REFRACT	refractometry
RESOLUTION	resolution of optical isomers
REVIEW	review; number of references given in abstract.
(RNA)	see NUCL.ACID
SEMIQUANT	a semiquantitative technique
SEPARATION	separation techniques other than IONX, CHROMATOG, DISTRIB. Example: Distillation. See also TECHNIQUE.
SEQ	reaction sequence
SOLAR	solar energy; see also ENVIRON
SOLID	solid state; solid structure
SOLUB	solubility; solution theory. Ksp: see KSP.
STATISTICS	statistics as applied to chemistry
(STEREOISOMERS)	see CHIRAL or GEOM
STOICH	stoichiometry
(STRUCTURE)	For proof-of-structure, see PROOF.For structure of solids, etc., see the appropriate keyword. For structural isomers, see ISOMER.
SUBST.RXN	nucleophilic substitution reaction.
SURFACE	surface chemistry; surface tension; surface effects; surfactants
(SVEX)	see DISTRIB.
TAUTOMERS	tautomers, tautomerization
TCHROME	thermochromicity
TECHNIQUE	any technique not indexed separately. Example: steam distillation
THERMO	thermodynamics; thermodynamic functions. For thermal effects & thermometry, see HEAT. See also CALORIM, DTA.
(TGA)	see DTA
TITN	titration
TLC	tlc; thin layer chromatography
TRACER	tracer techniques
TRANSPORT	transport properties. DIFFUSION and VISC are indexed separately. See also ELECTRCHEM.
(TURBIDIM)	turbidimetry, indexed under UVIS.
UVIS	ultraviolet and/or visible spectroscopy; uv or visible radiation. See also PHOTO.
VACTEK	vacuum techniques; vacuum lines; gas-handling systems; low pressure
VAPORPRESS	vapor pressure; vapor state
VISC	viscometry
VITAMIN	vitamins.
WATERCHEM	chemistry of natural waters, as rain, river, tap, sea, etc.
XRAY	X-ray analysis; X-ray spectroscopy

*ANAL INORG IR QUANTUM 2

Infrared Spectrometry of Inorganic Salts: A General Chemistry Experiment
Ackermann, M. N.
J. Chem Educ. 47 ,69 (1970)
KBr pellet technique (rapid). Molecular vibrations. 32 anhydrous binary salts. Requires an unknown.

*ANAL ELECTROCHEM 4

Electrodeposition of Silver and Copper Without the Use of Cyanide
Adams, R. J.; Blaedel, W. J.
J. Chem. Educ. 36 ,286 (1959)
Deposition from an ammoniacal solution onto a Pt gauze cathode. Caution: don't store ammoniacal silver solutions - explosion hazard.

*ANAL ACBA APPARATUS REDOX TITN UVIS 4

Spectrophotometric Titrations for Students
Amdur, S.; Levene, W. J.
J Chem Educ 51 ,136 (1974)
Rapid scanning spectrocolorimeter titration cell. Outlines for 6 titrations. Isosbestic point obs.

*ANAL ORG FRIEDEL.CRAFTS IR STATISTICS 4 HAZARD

Simplex Optimization of Yield in a Friedel-Crafts Alkylation. A Special Undergraduate Project in Analytical Chemistry.
Amenta, D. S., Lamb, C. E., Leary, J. J.
J. Chem. Educ 56 ,557 (1979)
Optimizing the yield of sec butylbenzene by simultaneously varying the molar ratio of 2-bromobutane to AlCl3 and temperature. Analysis by quant. IR.
HAZARD: Benzene is carcinogenic.

*ANAL QUAL WATERCHEM 1

Water Analysis Experiment
Anderlick, B.
J. Chem Educ 49 ,749 (1972)
Qualitative tests for ions: calcium, iron(III), iron(II), mercury(II), magnesium, chloride, nitrate, phosphate.

*ANAL INORG SEMIQUANT TECHNIQUE TLC 4

Slip Chromatography: A Semiquantitative TLC Technique
Andreasen, B.; Bohlbro, M.; Crossland, H.; Dennak, V.
J. Chem. Educ. 53 ,772 (1976)
Adsorbant = cellulose + carboxymethyl cellulose. Moving phase is a commercial buffer; method is for Pb^{++}; developer: diphenylcarbazide. calibration curve gives the length of Pb^{++} trace vs. concn.

*ANAL ORG NATPROD TLC 2 3

Separation of Plant Pigments by Thin Layer Chromatograph,
Anwar, M. H.
J. Chem. Educ. 40 ,29 (1963)
Careful TLC (under nitrogen, in the dark) gives good results. Discussion of developing solvents. (Caution: a few, eg. CCl_4, are carcinogenic.) Prep'n of silicic acid strips using wheat starch as a binder described. See also Rollins (1963).

*ANAL AA DEMO ENVIRON UVIS VAPORPRESS 0 HAZARD

Visualization of the Atomic Absorption of Mercury Vapor by Use of a Fluorescent Screen
Argauer, R. J.; White, C. E.
J. Chem. Educ. 49 ,27 (1972)
Simple apparatus (UV source, fluorescent screen, squeeze bottle) to illustrate vapor pressure of Hg using UV "shadow" of mercury vapor. (Also demonstrates atomic absorption.) Hazard: Hg vapor (toxic)

*ANAL INORG QUAL 3 HAZARD

Precipitation of the Hydrogen Sulfide Group of Ions Using Thioacetamide
Armstrong, A. R.
J. Chem. Educ. 37 ,413 (1960)
Textbooks and literature sources vary considerably in their descriptions of the use of thioacetamide as a replacement for H_2S, and some seem not to know that the chemical has properties which are quite different from those of H_2S. A method is given for the sulfide pptn which will give complete pptn of the sulfide group in one treatment. HAZARD: thioacetamide is a carcinogen.

*ANAL APPARATUS DTA VACTEK 5

High Vacuum DTA-TGA Instrumentation for Air-Sensitive Compounds
Ashby, E. C.; Bousquet, P. C. J.; Etienne, J.
J. Chem. Educ. 52 ,618 (1975)
High-tech method used to study thermal decomposition of $Mg(AlH_4)_2$ and $Mg(AlH_4)_2.2THF$.

*ANAL UVIS 2

Colorimetric Determination of Iron in Vitamin Supplement Tablets
A General Chemistry Experiment
Atkins, R. C.
J. Chem. Educ. 52 ,550 (1975)
Spec-20 calibration curve. Ortho-phenanthroline, hydroquinone.

*ANAL ORG QUAL TECHNIQUE 3

Use of the Oxygen Flask in Organic Qualitative Analysis
Ayres, D. C.; Dawson, B. E.
J. Chem. Educ. 42 ,270 (1965)
Combustion in oxygen followed by conventional AgX precipitation or other standard tests. Caution: possible explosive hazard.

*ANAL REDOX VITAMIN 2

The Determination of Ascorbic Acid: A Quantitative Analysis Experiment
Bailey, D. N.
J. Chem. Educ. 51 ,488 (1974)
Iodimetry. Unknowns or vitamin-C tablets.

*ANAL PHOTO TITN UVIS 2

The Analysis of a Silver-Copper Alloy
Baine, O.; Banewicz, J.
J. Chem. Educ. 34 ,297 (1957)
Home-made spectrophotometer incorporates a Weston model #594 Photronic photocell and a microammeter. Copper is det'd directly as the hydrated cation, silver by a modified Volhard titration.

*ANAL ACBA PHARM QUAL TITN 2

A Pharmaceutical Analysis Experiment for General Chemistry Laboratory
Baine, O.; Hicks, S.
J. Chem. Educ. 36 ,88 (1959)
Students identify active agent in a pharm. prepn. Tests for ascorbic acid, thiamine, phenobarbitol, quinidine, sulfathion. Quantitative analysis, all by acidimetry.

*ANAL INORG COORD IONX 3

Purifying and Identifying Transition Metal Complexes: An Experiment Using Cation Exchange Chromatography.
Balahura, R. J.; Lewis, N. A.
J. Chem. Educ. 53 ,324 (1976)
Cobalt(II) and (III) complexes. Details of column construction given.

*ANAL GC TECHNIQUE 3 4

A Combustion-Gas Chromatography Experiment
Bard, J. R.
J. Chem. Educ. 46 ,441 (1969)
Construction of simple combustion train. Measure CO2 gc peak areas, calibrate.

*ANAL ORG CONSUMERPROD NOPROC PROJ 4

Quantitative Laboratory Experiments Based on Reactions of Cyclamates
Barnes, R. M.
J. Chem. Educ. 49 ,272 (1972)
Detailed presentation of student results. See especially for novel use of nitrates and nitrous acid. Methods include gc, ir, kin, uvis, electroanal.

*ANAL INORG CATALYSIS REDOX 3 4

Induced Redox Reactions: An Experiment for Introductory Analytical Laboratory
Baron, B. N.; Aikens, D. A.
J. Chem. Educ. 46 ,246 (1969)
Mn(II) to Mn(III) oxidation induced by oxidation of As(III) by Cr(III) in phosphoric acid.

*ANAL PHYS CATALYSIS CLOCK KIN 2

Catalytic Determination of Trace Copper
Bartis, J. T.; Wiesenfeld, J. R.
J. Chem. Educ. 53 ,666 (1976)
The well-known Cu^{++} catalysis of the peroxydisulfate oxidation of iodide is adapted to the determination of trace copper. Calibration curve construction.

*ANAL 2

Analysis for Nitrite by Evolution of Nitrogen. A General Chemistry Laboratory Experiment
Bartlett, J. K.
J. Chem. Educ. 44 ,475 (1967)
Decomposition to nitrogen in presence of ammonium chloride. Ordinary lab glassware. Unknown sodium nitrite - sodium chloride mixture. Nitrogen gas collected over water.

*ANAL BIOCHEM HPLC INSTR SEPARATION 4

High Performance Liquid Chromatography of Urinary Compounds. An Undergraduate Experiment
Bastian, D. W.; Miller, R. L.; Halline, A. G.; Senftleber, F. C. Veening, H
J. Chem. Educ. 54 ,766 (1977)
Five clinically important urinary compounds (uracil, uric acid, xanthine, allopurinol and nicotinamide) separated and determined by reversed-phase LC. Separation is achieved by isocratic elution and UV detection.

*ANAL ACBA BIOCHEM CONSUMERPROD TITN 2

Pepsin and Antacid Therapy: A Dilemma
Batson, W. B.; Laswick, P. H.
J. Chem. Educ. 56 ,484 (1979)
Back-titration of an antacid-HCl solution to thymol blue. Criticizes other methods and indiscriminate antacid therapy.

*ANAL ORG QUAL 3 HAZARD

The Sodium Nitroprusside Reagent: A Classification Test for Aliphatic and Aryl Amines
Baumgarten, R. L.; Dougherty, C. M.; Nercessian, O.
J. Chem. Educ. 54 ,189 (1977)
Data on 29 aromatic amines. HAZARDS: dimethylsulfoxide absorbed thru skin; aryl amines are toxic, potential carcinogens.

*ANAL IONX QUAL 2

Elimination of Phosphates by Ion-Exchange in the Systematic Analysis of Cations
Bedetti, R.; Carunchio, V.; Tomassetti, M.
J. Chem. Educ. 53 ,122 (1976)
Cation exchange resin binds metals, not phosphate. Elution is followed by conventional analysis.

*ANAL ACBA APPARATUS ELECTROANAL NOPROC TITN UVIS 4

A Coulometric Titration Experiment: Simultaneous Potentiometric and Photometric Endpoint Detection
Beilby, A. L.; Landowski, C. A.
J. Chem. Educ. 47 ,238 (1970)
Special glassware and apparatus. Spec-20. Potentiometric and spectrometric determination of endpoint in titration of acid with electrolytically-generated hydroxyl ions.

*ANAL ELECTROANAL NOPROC PROJ 4

The Effect of Iodide Concentration on the Starch-Indicator End Point in the Coulometric Determination of As(III)
Bell, D. A.
J. Chem. Educ. 55 ,815 (1978)
Report of a class project. Endpoint was observed to be a gradually developing brown, hard to see and reproduce. Trouble located in that textbook-specified conc. of iodide was too high by a factor of 10.

*ANAL COLOR MICROSCOPE QUAL 2

Fusion Reactions Under the Microscope
Beneditti-Pichler, A. A.; Vikin, J.
J. Chem. Educ. 43 ,421 (1966)
A modification of the classical borax bead test uses electrically heated platinum wire under a microscope. Transition metals plus a few anions. Would make a good student project.

*ANAL IONX QUAL 3

Cation Analysis by Ion Exchange for the Course in Qualitative Analysis
Berend, J.; Westcott, L.; Wiig, E.
J. Chem. Educ. 35 ,68 (1958)
Intended for sophomores in classical qualitative analysis course. Modification of classical Group III analysis. Zn, Co, and Fe separated by use of an anion exchanger.

*ANAL INORG QUAL 2

The Detection of Acetate Ions in Qualitative Analysis
Berk, D.; Hecker, L.
J. Chem. Educ. 37 ,414 (1960)
A reliable test is described based on the fact that acetate ion pyrolyzes to carbonate.

*ANAL INORG EDTA QUAL 2

A Qualitative Analysis Test For Chromium
Berthold, Sr. M. E.; Huchital, D.
J. Chem. Educ. 50 ,340 (1973)
Identification via EDTA complex.

*ANAL DISTRIB ENVIRON PESTICIDE TLC 3

TCL Analysis of Carbaryl Insecticide on Sprayed Foliage: A Student Experiment
Bidleman, T F.; Rice, C. P.
J. Chem. Educ. 53 ,173 (1976)
Ambient leaves sprayed recently with carbaryl (= 1-naphthyl N-methylcarbamate) to control a gypsy moth infestation. Detailed procedure: silica plates; ethyl ether-hexane developer, visualization with NaOH spray. Caution: toxic compounds.

*ANAL COLLIG CRYO PROJ TECHNIQUE 2 3

Tert-Butyl Alcohol as a Solvent for Cryoscopic Measurements
Bigelow, M. J.
J. Chem. Educ. 45 ,108 (1968)
A technique note; students could extend the work by finding anomalous cases.

*ANAL INSTR UVIS 4

Principles of Precision Spectrometry: An Advanced Undergraduate Experiment
Billmeyer, F. W., Jr.
J. Chem. Educ. 51 ,530 (1974)
Uses Beckman DK 2A or similiar spectrometer to investigate instrument parameters.

*ANAL CONSUMERPROD ENVIRON FLUOR XRAY 3

X-Ray Fluorescence Determination of Lead in Gasoline
Bills, J. M.; Brier, K. S. ;Danko, L. G.; Kristine, F. J. ;Turco, S. J. Zimmerman, K. S.; Divelbiss, P. M.; Tackett, S. L.;
J. Chem. Educ. 49 ,715 (1972)
Special plexiglas cell, Picker solid-state x-ray generator, radiation analyzer. Caution: Lead is an embryotoxin.

*ANAL IONSELECT IONX TITN 4

Experiments with the PVC Matrix Membrane Calcium Ion-Selective Electrode.
Birch, B. J.; Craggs, A.; Moody, G. J.; Thomas, J. D. R.
J. Chem. Educ. 55 ,740 (1978)
Extension of J. Chem. Ed. vol 51, 54 (1974) to complex formation equilibria. Use of the electrode in titration of citrate, malate, malonate, and oxalate.

*ANAL INORG PHYS CLOCK KIN NOPROC STOICH 2

Spot Plate Chemistry: General Chemistry Experiments in a Depression
Birk, J. P.; Ronan, T. H.
J. Chem. Educ. 54 ,328 (1977)
Experiments adapted to spot plate operation: Composition of insoluble salts by method of continuous variation: Colorimetric analysis, eg. lead, kinetics of formaldehyde clock. Caution: some of the reagents, eg. lead, are suspected toxins.

*ANAL INORG QUAL 3

A New Reagent for the Identification of Magnesium and Bismuth
Bishop, J. A.
J. Chem. Educ. 37 ,410 (1960)
Brominated tetraresorcinol pyromellitein forms a crimson lake with Mg^{++}, and a scarlet lake with Bi(OH)3. Cu^{++} and Cd^{++} do not interfere.

*ANAL CONSUMERPROD UVIS 2

Analysis of Reducing Sugars in Breakfast Cereals and Other Foods
A General Chemistry Experiment.
Bittman, R.
J. Chem. Educ. 51 ,46 (1974)
3,5-Dinitrosalicylic acid reagent and standard glucose solutions are used to determine reducing carbohydrate after HCl hydrolysis in breakfast cereals. Does not determine sugar in cereals.

*ANAL ORG FORENSIC GC TECHNIQUE 3

The Recovery and Identification of Flammable Liquids in Suspected Arsons: An undergraduate organic experiment
Blackledge, R. D.
J. Chem. Educ. 51 ,549 (1974)
Procedure adapted from Florida Department of Law Enforcement involves steam distillation and GC.

*ANAL ORG COLUMNC TECHNIQUE TLC 3 HAZARD

"Dry-column" Chromatography: A new technique for the undergraduate laboratory
Bohen, J. M.; Joullie, M. M.; Kaplan, F. A.; Loev, B.
J. Chem. Educ. 50 ,367 (1973)
Separation of a dye mixture on a "dry column". Nylon column can be sectioned by cutting. Absorber = deactivated alumina. Moving phase is Benzene (HAZARD). Clear instructions and photographs.

*ANAL EDTA UVIS 4

Complexo-Turbidimetric Analysis of Cations in Solution
Bourque, C.; Mehra, M. C
J. Chem. Educ. 54 ,769 (1977)
Titration of a series of +2, +3 cations by this method: the cation is reacted with excess EDTA. Sodium chromate solution is added and mixture is back-titrated with standard Pb^{++} solution. Endpoint is permanent yellow turbidity. Results are compared with those obtained using xylenol orange.

*ANAL PHYS ELECTROCHEM GRAVIM STOICH TITN 2

Mysterious Stoichiometry
Bowman, L. H.; Shull, C. M.
J. Chem. Educ. 52 ,186 (1975)
0.3M KOH electrolyzed at 1 amp for 1 hour using Cr metal cathode, weighed stainless steel (inert) anode. Yellow solution resulting from electrolysis is acidified and titrated with standard Pb. Student is asked to find stoichiometric formula for the precipitate ($PbCrO_4$). Stony Brook suggestion: Bowman & Schull report titration endpoint unsatisfactory. Possible use of modified Job's method using height ppt. in centrifuge tube?

*ANAL INORG DISTRIB QUAL 3 HAZARD

Separation of Copper(II) From Cadmium(II) in Qualitative Analysis
Boyd, C. C.; Easley, W. K.
J. Chem. Educ. 35 ,406 (1958)
Cu^{++} is extracted selectively by ,-hydroxyquinoline-chloroform solution. HAZARD: both chloroform and 8-hydroxyquinoline are suspected carcinogens.

*ANAL INORG DISTRIB QUAL 3 HAZARD

The Separation of Arsenic in Qualitative Analysis
Boyd, C. C.; Easley, W. K.
J. Chem. Educ. 36 ,384 (1959)
Short note. Arsenic is selectively extracted from HCl solution by a sol'n of catechol in benzene. HAZARDS: benzene, H_2S, arsenic.

*ANAL NMR 4

NMR Analysis of Water-Acetic Acid Solutions
Brabson, G. D.
J. Chem. Educ. 46 ,754 (1969)
Proton NMR. Low resolution NMR spectrometer should be satisfactory.

*ANAL ELECTROANAL GLOVEB NONAQ TITN 4 HAZARD

The Simultaneous Potentiometric Titration of Cu and Fe in Non-Aqueous Media
Braun, R. D.
J. Chem. Educ. 53 ,463 (1976)
Medium: dimethylformamide (DMF). Titrant: titanium (III) chloride in DMF. Inert gas. HAZARD: titanium (III) chloride reacts vigorously with trace water evolving HCl gas.

*ANAL APPARATUS BIOCHEM ELECTROPHOR GELC 4 HAZARD

Disk Electrophoresis
Brewer, J. M.; Ashworth, R. B.
J. Chem. Educ. 46 ,41 (1969)
Preparation of polyacrylamide gels (at different pH) in layers by photopolymerization. Use in separating proteins, nucleic acids only by reference. Apparatus for parallel of disk electrophoresis and also for prep. scale. HAZARD: acrylamide is toxic; benzene, a carcinogen.

*ANAL ORG COLOR TLC 3

Small-Scale Thin-Layer Chromatography: Experiments for teaching purposes
Brinkman, U. A. Th.; DeVries, G.
J. Chem. Educ. 49 ,545 (1972)
Suggested expts include separation of dye mixtures, amino acids, inks, cations, etc. Novel developing chamber. Commercial plates.

*ANAL CHROMATOG IONX PAPERC QUAL TLC 4

Liquid Anion-Exchangers in Reversed-Phase Extraction Chromatography
Brinkman, U. A. Th.; DeVries, G. .
J. Chem. Educ. 49 ,244 (1972)
Eight liquid anion exchangers investigated. Silica gel or paper impregnated with the resins used to separate mixtures of metal ions in HCl solution. Visualization by spraying with organic reagents, eg., dithizone. Rf vs. HCl conc. plots for 29 cations.

*ANAL INORG BIOCHEM COMPLEXIM PORPHYRIN UVIS 4

The Micro-Determination of Porphyrins: An Integrated Laboratory Experiment
Brisbin, D. A.; Asgill, J. O.
J. Chem. Educ. 51 ,211 (1974)
Recording UVIS spectrophotometer. Porphyrin extracted from biological material (noproc) determined by spectrophotometric titration with standard solution of a transition metal (Mn,Ni,Cu,Zn) acetate; alternatively, analysis for transition metal concentration using standard protoporphyrin dimethyl ester.

*ANAL ORG PAPERC 3

Paper Chromatographic Separation of 2,4-Dinitrophenylhydrazones
Burnett, M. C.
J. Chem. Educ. 43 ,385 (1966)
Easy separation of alkyl aldehyde and ketone, including two-dimensional for a few.

*ANAL INORG QUAL 3

Benzenoid Nitro-Compounds as Organic Reagents for Tin(II)
Burns, R. L., Gruen, F. M.
J. Chem. Educ. 38 ,410 (1961)
2% Naphthol Yellow S, 2% 2,4-dinitrophenol, and 2% meta-dinitrobenzene give characteristic colors with the Group II and III cations in the presence of KOH.

*ANAL GRAVIM TECHNIQUE TITN 2

Gravimetric Titrimetry: A neglected technique
Butler, E. A., Swift, E. H.
J. Chem. Educ. 49 ,425 (1972)
Use of a 2-oz. polyethylene washbottle as a gravimetric buret.

*ANAL ASPIRIN CONSUMERPROD HPLC INSTR 3 4

Two HPLC Experiments for Instrumental Analysis Laboratory
Byrd, J. E.
J. Chem. Educ. 56 ,809 (1979)
Analysis of 1) components of APC tablets, 2) saccharin, sodium benzoate and caffeine in diet cola.

*ANAL INORG QUAL REDOX 4

Systematic Detection of Anions Through Their Parent Elements
Caldas, A.; Gentil, V.
J. Chem. Educ. 35 ,545 (1958)
Research report. Development of a system of reactions to reduce anions to their elements, which are then determined by classical wet methods. The scheme is (1) boil with alkali, (2) reduce with Al metal, (3) reduce with sodium formate, etc. Translated from the Spanish by Ralph E. Oesper. The anions intended are coordination polyhedra with oxygen or fluorine as the ligands, eg. ClO4-.

*ANAL NATPROD TLC 1

An Investigation of Sebum and Other Facial Lipids
Calsin, D.; Trinler, W. A.
J. Chem. Educ. 50 ,135 (1973)
Oils from skin taken up in ether, chromatographed on silica gel using petroleum ether: ether; acetic acid and with cholesterol, squalene, tristearin, oleic acid, cetyl palmitate standards.

*ANAL COLORIM COORD KEQ UVIS 4

Demonstrating Job's Method with Colorimeter or Spectrophotometer
Carmody, W. R.
J. Chem. Educ. 41 ,615 (1964)
Job's method for FeCNS(++) equilibrium - a low stability complex, for which this method was designed.

*ANAL CONSUMERPROD GC 2 3

Gas Chromatographic Analysis of Gasoline: A Laboratory Experiment
Cassidy, R. F.; Schuerch, C.
J. Chem. Educ. 53 ,51 (1976)
Straightforward. Intended for upperclass non-majors.

*ANAL UVIS 2

Colorimetric Analysis for Salicylate in Urine: An Experiment for Nursing Chemistry.
Cavanaugh, M. A.; Bambenek, M. A.
J. Chem. Educ. 55 ,464 (1978)
Standard salicylate samples and unknowns issued. Student is required to draw up standardization curve, at 535 nm. One 2-hr lab period.

*ANAL QUAL 2

Interference with the Molybdate Test for Phosphate in Qualitative Inorganic Analysis
Cavanaugh, M. A.; Pilger, R. C., Jr.
J. Chem. Educ. 56 ,342 (1979)
Two methods given for overcoming the interference of iodide in the pptn of ammonium phosphomolybdate.

*ANAL QUAL 3 HAZARD

Non-Cyanide Detection of Cadmium in the Presence of Copper
Chandra, R.
J. Chem. Educ. 38 ,409 (1961)
Six new methods using ordinary and organic reagents. HAZARD: Cadmium.

*ANAL QUAL 2 3

Detection of Phosphate in the Presence of Arsenate
Chandra, R.
J. Chem. Educ. 38 ,408 (1961)
Ammonium molybdate, sodium dithionate. Rapid, semimicro, qualitative.

*ANAL INORG QUAL 2 HAZARD

Rapid Detection of Cations of Copper Group
Chandra, R.
J. Chem. Educ. 38 ,413 (1961)
Short note suggests removal of Hg^{++} from qual. solutions by deposition on Al+3 foil; det'n of Bi^{+++} as the phosphate; pptn of Cu^{++} as the metal with dithionate ($S_2O_4^=$). HAZARD: procedure was devised before Cd^{++}, thioacetamide were known to be hazardous chemicals.

*ANAL QUAL 2

Detection of Barium, Strontium, and Calcium with Sodium Rhodizonate
Chandra, R
J. Chem. Educ. 39 ,397 (1962)
Specific tests and scheme for mixtures.

*ANAL NOPROC QUAL 2 HAZARD

Specific Tests for Cations of Group II
Chandra, R.; Jindal, H. R.
J. Chem. Educ. 39 ,396 (1962)
Outline; most by reference. Some of the reagents suggested are now known to be severe health hazards.

*ANAL QUAL 2

Detection of Ferrocyanide, Ferricyanide, and Thiocyanate
Chandra, R.; Sharma, S. L.
J. Chem. Educ. 39 ,397 (1962)
Specific tests for differentiating.

*ANAL ASPIRIN CONSUMERPROD PHARM TLC 3 HAZARD

Thin-Layer Chromatography of Darvon Compound-65
Chasar, D. W., Toth, G. B.
J. Chem. Educ. 51 ,487 (1974)
Silica gel, chloroform-methanol moving phase, visualization with fluorescein. Caffeine, aspirin standards. CAUTION: prescription drug HAZARD: chloroform (carcinogen).

*ANAL INORG REDOX STOICH TITN 2

The Stoichiometry of an Oxidation-Reduction Reaction: An Elementary Chemistry Experiment.
Child, W. C., Jr.; Ramette, R. W.
J. Chem. Educ. 44 ,109 (1967)
Stoichiometry of reaction of hydroxylamine with iron(III) by titration of reduced iron with standard permanganate.

*ANAL INORG QUAL 3

Toluene-3,4-dithiol and its Derivatives as Analytical Reagents: A New Approach to Qualitative Inorganic Analysis
Clark, R. E. D.; Neville, R. G.
J. Chem. Educ. 36 ,390 (1959)
Separations into groups I - IV by conventional methods is followed by use of toluene-3,4-dithiol as precipitating agent; it yields characteristically colored mercaptates. Catechol substitutes for ammonia in this procedure.

*ANAL AA IONX 4 HAZARD

The Separation of a Sodium-Rubidium Mixture on an Ion Exchanger
A Laboratory Experiment
Coetzee, C. J.
J. Chem. Educ. 49 ,33 (1972)
Ammonium molybdophosphate exchanger. Column preparation procedure given AA spectrometer or flame photometer. HAZARD: asbestos powder.

*ANAL GRAVIM KSP SOLUB 3

Solubility of Lead Bromide in Nitrate Media: A Study of Ionic Interactions
Cooper, J. N.
J. Chem. Educ. 49 ,282 (1972)
Lead chromate pptd from homogeneous solution (1), or chromate is generated by oxidation of Cr(III) with bromate (2), in gravimetric determination of lead as chromate.

*ANAL ELECTROANAL REDOX STOICH 3 HAZARD

The Oxidation of Hydrazine by Basic Iodine Solutions:
a Stiochiometric Study
Cooper, J. N.; Ramette, R. W.
J. Chem. Educ. 46 ,872 (1969)
Ratio of reactants and nature of products posed as a problem. Hydrazine standard, iodine by back potentiometric titration. Hydroxide by titration. Can be extended to analysis of gas product. Don't let student read it, spoils the fun.
HAZARD: Standardization of hydrazine with iodate uses ICl as a catalyst. ICl causes severe burns.

*ANAL INSTR MOL.SPECT 5

Determination of the Performance Parameters of a Spectrophotometer: An Advanced Analytical Experiment.
Cope, V. W.
J. Chem. Educ. 55 ,680 (1978)
Problem posed is the selection of a spectrophotometer. Determination of baseline linearity, absorbance stability with time, signal/noise ratio, resolution, etc.

*ANAL CONSUMERPROD FLUOR 2 3

Simple Fluorimetric Analysis of Glycine in Dietetic Beverages
A Student Experiment
Coppola, E. D.; Hanna, J. G.
J. Chem. Educ. 53 ,322 (1976)
Perkin Elmer #203 Spectrofluorimeter used. Employs a new reagent, 4 phenylspiro(furan-2(3H),1'-phthalan)-3,3'-dione (fluorescamine), for determination of primary amines and amino acids at picomole levels.

*ANAL ORG ASPIRIN DISTRIB TLC 2 3 HAZARD

Thin Layer Chromatographic Separation of Common Analgesics: A Consumer Experiment.
Cormier, R. A.; Hudson, W. B.; Siegel, J. A.
J. Chem. Educ. 56 ,180 (1979)
Initial extraction with chloroform (HAZARD - carcinogen). Silica plates with fluorescent indicator. Moving phase: 1-butyl alcohol/ methyl 2 butyl ketone/ ethyl acetate. Visualization by uv light. Rf values given for 5 candidate compounds.

*ANAL ELECTROANAL INSTR 4

Qualitative and Quantitative Analysis Using a Rapid-Scanning Polarograph: An Experiment for Undergraduate Instrumental Analysis.
Cotter, R. J.
J. Chem. Educ. 54 ,457 (1977)
Instrument modifications, then straightforward. Co^{++}, Cd^{++}, Zn^{++}, etc. in aqueous solution.

*ANAL ORG GC NATPROD 3

The Identification of Vegetable Oils - A Gas Chromatographic Experiment
Cover, R. E.
J. Chem. Educ. 45 ,120 (1968)
Unkn. vegetable oil saponified and injected as methyl esters. Flame ionization detector and thermal conductivity detector. Methylating agents are $NaOCH_3$ and BF_3.

*ANAL EDTA PHARM 3

Preparation of Variable Purity Samples for Use in Disodium EDTA-ate Volumetric Analysis.
Cox, P. J.
J. Chem. Educ. 54 ,717 (1977)
Author teaches analytical chemistry to pharmacy students. In analyzing commercial samples, students may read the analysis from the container, and realize what the results of their analysis should be. To avoid this bias, methods for preparing similar unknowns (ointments, powders, etc.) are described in this article.

*ANAL ELECTRODE IONSELECT IONX 4

PVC Matrix Membrane Ion-Selective Electrodes; Construction and Laboratory Experiments.
Craggs, A.; Moody, G. J.; Thomas, J. R. D.
J. Chem. Educ. 51 ,541 (1974)
Calibration, determinations with calcium/nitrate ion-selective electrodes. Uses liquid ion exchangers, polyvinyl chloride powder in the construction.

*ANAL ELECTROPHOR TECHNIQUE TLC 4 5 HAZARD

Electrophoresis Using Thin Layer Materials
Criddle, W. J.; Moody, G. J.; Thomas, J. D. R.
J. Chem. Educ. 41 ,609 (1964)
Silica plates. Organic dye samples. Refer earlier publications for electrophoresis. Uses high voltage power supply (hazard), borax electrolyte.

*ANAL PAPERC 2 3

Paper Chromatography of Carbohydrates
Croft, L. R.; Haghighi, S.
J. Chem. Educ. 54 ,112 (1977)
Chem. Ed. Compact. Solvent: 1-butanol-HOAc-water. Visualization by 1% NaOH in 60% ethanol-water. Author says carbohydrates appear as yellow or light brown spots. No data.

*ANAL APPARATUS ERROR STATISTICS 3

Data Correlation Experiment
Cunning, J. D.; Burnet, G., Jr.; Levenspeil, O.
J. Chem. Educ. 41 ,35 (1964)
Random error simulator produces data to fit linear and higher order polynomials. Circuit given. Simulate least squares, linear regression analysis.

*ANAL CONSUMERPROD UVIS 2

A Spectrophotometric Determination of Fluoride Adapted for the Freshman Laboratory
Daines, T. L.; Morse, K. W.
J. Chem. Educ. 51 ,680 (1974)
Sodium 2-parasulfophenylazo-1,6-dihydroxy-3,6-naphthalene disulfonate. zirconyl chloride, toothpaste unknown
CAUTION: fluorides - toxic.

*ANAL CATALYSIS REDOX TITN 3

An Improved Method in the Redox Titration of Oxalic Acid by Permanganate
Datta, M.; Ameta, S. C.; Pande, P. N.; Gupta, H. L.; Bokadia, M. M.
J. Chem. Educ. 56 ,659 (1979)
Ascorbic acid catalyzes this reaction, so titration can be carried out without heating. Empirical.

*ANAL SEMIQUANT UVIS 1 2

Evolution of an Experiment (from Moles Per Liter Squared to Gaseous CaCl2)
Dauphinee, G. A.
J. Chem. Educ. 56 ,116 (1979)
Analysis of trace iron in reagent-grade calcium hydroxide by SCN- colorimetry, leads to apparently contradictory results with salicylic acid test for iron III. Good: do not let the students read it.

*ANAL CONSUMERPROD ELECTROANAL 4 HAZARD

Determination of Pb and Cd in Pottery Using Anodic Stripping Voltammetry.
Deanhardt, M. L.; Dillard, J. W.; Hanck, K. W.; Switzer, W. L.
J. Chem. Educ. 54 ,55 (1977)
FDA leaching process given. Polarograph, recorder, hanging mercury drop electrode. Hazards: Pb, Cd.

*ANAL INORG NOPROC QUAL 2

First Semester Qualitative Analysis
DeLap, J. H.
J. Chem. Educ. 46 ,837 (1969)
Students devise qual. schemes for four groups (three cation, one anion) and then do unknowns.

*ANAL DISTRIB UVIS 3 HAZARD

The Effect of pH on the Extraction of Copper Oxinate into Chloroform.
Dilts, R. V.
J. Chem. Educ. 47 ,661 (1970)
Copper-8-Hydroxyquinoline complex extracted; determined by colorimetry. Requires accurate pH meter. Spec-20.
HAZARD: CHCl3 is a carcinogen

*ANAL ENVIRON GC 3

Hydrocarbons in Ambient Air.
Dinardi, S. R.; Briggs, E. S.
J. Chem. Educ. 52 ,811 (1975)
Calibration curve from pure methane mixtures with pure air, direct injection gives 0.5 - 5 ppm range. Note that concentration by absoption techniques are used for analysis of lower concentrations.
Flame ionization detection, gas sampling valve, flow meter, 100 ml gas syringe. Planimeter (or integrator).

*ANAL COMPUTER ELECTROANAL TITN 2

A Computerized Soda Ash Experiment for First Year College Chemistry
Dinga, G. P.
J. Chem. Educ. 46 ,60 (1969)
Double indicator titration, potentiometric titration, computer program (on request) for first and second deriv. plots.

*ANAL ACBA COMPUTER DEMO ELECTROANAL TITN 3

Automatic and Microcomputer-controlled Potentiometric Titrimetry.
Doane, L. M.; Stock, J. T.; Stuart, J. D.
J. Chem. Educ. 56 ,415 (1979)
Microcomputer control of flow rate and cutoff in potentiometric titration. No hardware details. Program in BASIC available from authors.

*ANAL ORG QUAL 3

Identification of Carboxylic Acids
Duff, J. G.; Yung, D. K.; Brenner, R. J.; Wilson, B. J.; Racz, W. J.
J. Chem. Educ. 46 ,388 (1969)
Piperazinium salts of unknown carboxylic acids prepared (table).
Data collection (extensive).

*ANAL APPARATUS FLUOR UVIS 3

A Laboratory Experiment in Fluorescence Using the Spectronic 20.
Duncan, R. L.; Kirkpatrick, J. W.; Neas, R. E.
J. Chem. Educ. 49 ,550 (1972)
Requires spectrophotometer modification - filters. Prep'n of calibration curve from quinine sulfate/dil. H_2SO_4, and analysis of a constructed unknown. Within capacity of most univ. freshmen. Caution: uv lamp.

*ANAL QUAL 3 HAZARD

Non-cyanide Detection of Cadmium
Dutta, R. L.; Choudhury, S. D.
J. Chem. Educ. 40 ,414 (1963)
Biguanide acid sulfate; N-benzoylphenylhydroxylamine.
HAZARD: Cadmium is toxic.

*ANAL DIFFUSION SEMIQUANT 2

Quantitative Analysis of Silver-Copper Alloys by Diffusion in Gelatin
Eby, Sr. D.
J. Chem. Educ. 39 ,406 (1962)
Low chloride gelatin. Conc. of silver ions and of copper ions (latter differentiated by oxine or ferrocyanide reaction) is proportional to diameter of diffusion "zone". Not clear why this is a linear relation. Not very accurate.

*ANAL ACBA SOLUB TITN 2

The Solubility Curve of Borax: A student laboratory experiment
Eddy, R. D.
J. Chem. Educ. 35 ,364 (1958)
A "first-titration" experiment. Saturated borax solutions are diluted and titrated with standard 0.25M HCl. This is not an acid-base reaction in the usual sense, but a displacement reaction in which the weak boric acid is displaced by the stronger HCl. $Na_2B_4O_7 + 2HCl + 5H_2O$ yields $2NaCl + 4HBO_3$. Indicator: methyl red.

*ANAL INORG QUAL REDOX TECHNIQUE 3

Applications of Sodium-Lead Alloy in Qualitative Inorganic Analysis
Edge, R. A.; Fowles, G. W. A.
J. Chem. Educ. 42 ,436 (1965)
Data collection. Color-reaction, etc. in acid and basic media.

*ANAL CONSUMERPROD TLC 1

Separation of Paprika Pigments - An Introductory TLC Experiment
Elder, J. W.; Abbruzzese, J.; Murray, J.; Zielski, M.
J. Chem. Educ. 53 ,43 (1976)
Paprika, cayenne, chili pepper, etc. Extracted with dichloromethane. TLC or silica gel fluorescent indicator, with CH_2Cl_2 as moving phase. We've had a little trouble with it at Stony Brook, but it does work. Caution: CH_2Cl_2 should be used in the hood.

*ANAL ORG ELECTROANAL TITN 3

Coulometric Titration of Cyclohexene with Bromine
Evans, D. H.
J. Chem. Educ. 45 ,88 (1968)
Bromine generated by constant current electrolysis of bromide. End point detected amperometrically. Useful for trace unsaturates determination.

*ANAL ELECTROANAL QUAL 1

Electrographic Analysis of the Iron Triad: A general chemistry experiment
Feinstein, H. I.
J. Chem. Educ. 49 ,268 (1972)
1.5 volt dry cell, electro-spot tests; color-developing reagents are potassium ferricyanide, potassium thiocyanate, dimethylglyoxime.

*ANAL ACBA ELECTROANAL REDOX 3 HAZARD

Simple Experiments in Amperometry; Determination of Acids and Oxidizing Agents
Feldman, F. J.
J. Chem. Educ. 43 ,378 (1966)
Standardize with addition of 0.01 N perchloric acid to standard iodide-iodate solutions. Uses a microammeter, potentiometer, Pt electrodes, mag. stirrer. Hazard: $HClO_4$ is a storage hazard.

*ANAL QUAL 1

The Identity of Chemical Substances: A First Laboratory Experiment for Elementary Chemistry Students.
Fernandez, J. E.
J. Chem. Educ. 53 ,718 (1976)
Students are given two test tubes each containing a solid and asked to say if the two solids are the same or different. (e.g., NaCl and sucrose crystals). Study questions given. High School Forum note.

*ANAL NOPROC QUAL 1

The Identity of Chemical Substances: A first laboratory experiment for elementary chemistry students
Fernandez, J. E.
J. Chem. Educ. 52 ,726 (1975)
A "same or different?" experiment described. Study questions given.

*ANAL ASPIRIN CONSUMERPROD INSTR UVIS 3

An Experiment for Instrumental Analysis: determination of aspirin by ultraviolet absorbtion
Fernandez, L. T.; Klappmeier, F. H.
J. Chem. Educ. 55 ,266 (1978)
Aspirin is determined in commercial products by hydrolyzing to salicylic acid. This compound has an absorption peak in the near UV allowing calibration with standard salicylic acid solutions.

*ANAL INORG DISTRIB QUAL 3

Improved Confirmatory Test for Chromium
Ferrand, E. F., Jr.
J. Chem. Educ. 37 ,411 (1960)
CrO5 extracted with ethylene glycol mono-butyl ether. Bibliographers note: the extracted species is said to be CrO5 four times in this article.

*ANAL INORG ORG DISTRIB QUAL 3 HAZARD

The Use of N-Chlorosuccinimide for Identification of Bromide and Iodide Ions
Filler, R.
J. Chem. Educ. 35 ,412 (1958)
N-Chlorosuccinimide solutions will oxidize bromide and iodide to the corresponding halogens. These can then be identified by extraction with CHCl3 or CCl4. HAZARDS: chloroform, carbon tet. - substitute CH2Cl2.

*ANAL NOPROC QUAL 2

Versus/Versus - A Lab that Students Don't Dread
Flath, P. C.; Uhorchak, R. E.
J. Chem. Educ. 55 ,335 (1978)
Reports successful use of a "same or different" qual. experiment.

*ANAL CONSUMERPROD GC 3 HAZARD

Polyunsaturation in Margarines
Flynn, J. J.
J. Chem. Educ. 54 ,322 (1977)
BF3/ CH3OH as methylating agent in transesterification. GC analysis requires standard fatty acid methyl ester sample.
HAZARD (avoidable): Benzene used in extraction; use a substitute.

*ANAL ORG CONSUMERPROD IR TLC 3

Partial Analysis of Vinyl-Asbestos Floor Tile: A TLC Experiment for Beginning Organic Chemistry
Foreman, W. A.; Paulson, D. R.
J. Chem. Educ. 49 ,572 (1972)
Tetrahydrofuran extraction gives polymer, analyzed by IR of thin film and plasticizer. TLC analysis with bis(2-ethylhexyl)sebacate as a standard. Rf values given for various plasticizers.

*ANAL ORG COLOR COLUMNC 2 3

Dye Unknowns for Use in Column Chromatography
Freese, J. M.; Olesen, B.; Pinnick, H. R., Jr.; Useted, J. T.
J. Chem. Educ. 54 ,684 (1977)
Pedagogic. 12 candidates for adsoption on an alumina column may be permuted into 36 different mixtures, so that each student has his/her own unknown. 95% ethanol followed by water.

*ANAL ELECTRODE IONSELECT 3

Inexpensive Solid-State Ion-Selective Electrodes for Student Use
Fricke, G. H.; Kuntz, M. J.
J. Chem. Educ. 54 ,517 (1977)
Methods for construction of various ion-selective electrodes given, from silver chloride and from silver sulfide-metal sulfide coprecipitates and silicone grease, together with a list of suggested experiments. A student can prepare one of these electrodes and use it to test for Ag^+ in one lab period, and for Cl- or metal ratios in a second period.

*ANAL PAPERC UVIS 4

A Quantitative Experiment with Paper Chromatography
Frierson, W. J.; Marable, N.; Bruce, B
J. Chem. Educ. 40 ,408 (1963)
Determination of Zn, Cu, Co, Ni. Samples recovered from chromatogram and analyzed colorimetrically (Spec-20). Reagents: dithizone, rubeanic acid, 1,2,3-cyclohexanetrione trioxime, Zinion reagent.
Six 3-hr lab periods.

*ANAL TECHNIQUE TLC UVIS 3

Reflectance Spectroscopic Analysis of Dyes Separated by Thin Layer Chromatography
Frodyma, M. M.; Frei, R. W.
J. Chem. Educ. 46 ,822 (1969)
Beckman DU with std. reflectance attachment. This paper reports results of student experiment in introd. anal. chem. on identification of the components of a dye mixture, and quant. anal. for one component. Requires standard dye samples.

*ANAL BIOCHEM NOPROC PROJ TITN VITAMIN 2

Vitamin C and the Diet of a Student
Fulkrod, J. E.
J. Chem. Educ. 49 ,738 (1972)
Describes successful classroom use of 2,6-dichlorophenolindophenol titration to determine Vitamin C in urine. For non-majors.

*ANAL BIOCHEM UVIS 2 3

Determination of p-Aminobenzoic Acid in Urine
Gammans, R. E.; Stewart, J. T.
J. Chem. Educ. 51 ,275 (1974)
Standard p-aminobenzoic acid is used. Unknowns constructed from urine and added p-aminobenzoic acid. Spec-20. Color development by diazotization and coupling with N-(1-naphthyl)ethylenediamine.2HCl.

*ANAL INORG QUAL SOLUB 2 HAZARD

Detection of Thiocyanate and Dissolution of Silver Halides
Gentil, V.; Caldas, A.; Oesper, R. E.
J. Chem. Educ. 36 ,386 (1959)
A very short note on the separation of thiocyanate from the other four ions of the chloride group of anions in the conventional qual. scheme. HAZARD: SCN- is converted to CN- and S=.

*ANAL ORG CHROMATOG FRIEDEL.CRAFTS ORGANOMETAL 4

The Separation of Ferrocene, Acetylferrocene and Diacetylferrocene: A dry-column chromatography experiment
Gilbert, J. C.; Monti, S. A.
J. Chem. Educ. 50 ,369 (1973)
Column - alumina, eluant - CH2Cl2. Sample is prepared by Friedel-Crafts acylation of ferrocene with acetic anhydride/phosphoric acid (reference given). Technique of dry-column thoroughly explained.

*ANAL ENVIRON UVIS WATERCHEM 3 HAZARD

Nitric Acid in Rain Water.
Gleason, G. I.
J. Chem. Educ. 50 ,718 (1973)
Cadmium amalgam reductor converts nitrate to nitrite. This is subjected to azo dye formation and subsequent colorimetric analysis. Reductor requires glass-blowing. Reagents: l-naphthyl-ethylenediamine, sulfanilic acid. HAZARD: cadmium powder - MUST WEAR RESPIRATOR.

*ANAL CONSUMERPROD UVIS 2

Determination of Nitrite in Meat Samples
Glover, I. T.; Johnson, F. T.
J. Chem. Educ. 50 ,426 (1973)
Hot water extraction of processed meat products in a blender. Color-developing reagent is N-(1-naphthyl)ethylenediamine.

*ANAL GC NOPROC PESTICIDE TLC UVIS 4

Analysis of Chlorinated Hydrocarbon Pesticides: Experiments for Nonscience Majors
Glover, I. T.; Minter, A. P.
J. Chem. Educ. 51 ,685 (1974)
TLC (silica gel) for DDT, Dieldrin, etc. Quant. UV spectrophotometry on eluate. Internal standard: Benzophenone. Further analysis, GC - flame ionization detector. Advanced level of experimentation.
Caution: pesticides - extr. toxic

*ANAL CHROMATOG PHASE 3

An Experiment Illustrating Countercurrent Chromatography With Simple Apparatus
Godinho, O. E. S.; Braga, G. L.
J. Chem. Educ. 52 ,258 (1975)
Sep'n of bromcresol purple and phenol red. In this technique, 1-butanol is the unsupported stationary phase. The moving phase is 0.05M Na2CO3. Apparatus simply constructed.

*ANAL COORD ELECTROANAL GLOVEB KEQ 3

Formation Constants of a Metal-Amine System: Potentiometric titration experiment
Goldberg, D. E.
J. Chem. Educ. 39 ,328 (1962)
Formation constants for copper-ethylenediamine by titration in stirred apparatus under nitrogen. Caution: perchloric acid, although used in dilute soln, is a storage hazard. Much detail on theory.

*ANAL QUAL TLC 2

Cation Analysis with Thin Layer Chromatography
Goller, E. J.
J. Chem. Educ. 42 ,442 (1965)
Alumina thin layer plates; construction detailed. Ordinary lab glassware. Moving phase is (NaBr/1M HCl)/isopropanol. Visualization by DMG, etc., sprays. Ordinary qual cations and reagents.

*ANAL COMPLEX DEMO GRAVIM 4

Precipitation from Homogeneous Solution: A lecture demonstration
Gordon, L.; Salesin, E. D.
J. Chem. Educ. 38 ,16 (1961)
Precipitation of Ni^{++} with DMG generated homogeneously from biacetyl and hydroxylamine.

*ANAL COMPUTER ERROR NEUTRON NOPROC PROJ 3

Analysis of Binary Ammonium Salts: Evaluation of error by computer program
Gordus, A. A.; Hanson, J. C.
J. Chem. Educ. 42 ,485 (1965)
Students get a mixture, analyze it qual. and quant. NH_4^+ by Kjeldahl, anions by method of their choosing. Computer program to analyze errors. Neutron radiation analysis for halide.

*ANAL CONSUMERPROD PH 1

The pH of Hair Shampoos. A Topical High School Experiment.
Griffin, J. J.; Cocoran, R. F.; Akana, K. K.
J. Chem. Educ. 54 ,553 (1977)
The pH of the more popular brands of shampoos have been determined both directly from bottle and in 1/10 dilution. Relevance for hair cleaning discussed.

*ANAL APPARATUS ELECTROANAL REDOX 3

Coulometry Using Simple Electronic Devices
Grimsrud, E.; Amend, J.
J. Chem. Educ. 56 ,131 (1979)
Two coulometry experiments: 1) Hydrazine by electrically generated bromine, 2) Ferrous in ferrous salts. Operational amplifier

*ANAL ORG DRYLAB GC ISOMERS MASSPEC 3

Illustrating Gas Chromatography and Mass Spectrometry: An undergraduate experiment
Gross, M. L.; Olsen, V. K.; Force, R. K.
J. Chem. Educ. 52 ,535 (1975)
GC separation of isomeric ketones. Mass spec. can be done as a dry lab. Unknown (mixture of six $C_6H_{12}O$, or $C_7H_{14}O$, ketones).

*ANAL INORG QUAL 2

Blue-Violet For Nitrate Ion
Grotz, L. C.
J. Chem. Educ. 50 ,63 (1973)
In highly acidic solution, nitrate oxidizes colorless diphenylamine to diphenylbenzidine violet (which is blue). Prepn. of reagent, interferences described.

*ANAL DIFFUSION GAS GC INSTR NOPROC 4

Measurements of Gaseous Diffusion Coefficients by Gas Chromatography
Grushka E.; Maynard, V.
J. Chem. Educ. 49 ,565 (1972)
Diffusion coefficient of gaseous mixture (He-Ne). Requires GC w. 20 feet of one-quarter inch metal tubing. Chromatographic theory introduced.

*ANAL PHYS DEMO DISTRIB NOPROC PHASE 4 HAZARD

The Diisopropyl Ether Extraction of Iron(III) Chloride
Guenther, W. B.
J. Chem. Educ. 42 ,277 (1965)
Three liquid layer demonstration. Used also for iron(III) estimation from phase diagram. HAZARD: diisopropyl ether forms explosive peroxides if stored dry.

*ANAL CONSUMERPROD PROJ REDOX TITN VITAMIN 2

Vitamin C Content of Commercial Orange Juices: An Analytical Project
Haddad, P.
J. Chem. Educ. 54 ,192 (1977)
Reagents: either 2,6-dichlorophenolindophenol or N-bromosuccinimide; each standardized with ascorbic acid.

*ANAL ASPIRIN DISTRIB IR PHARM QUANT UVIS 2 3 HAZARD

Separation of an APC Mixture: A Quantitative Analysis Experiment
Haddad, P.; Rasmussen, M.
J. Chem. Educ. 53 ,731 (1976)
Multipurpose experiment to illustrate basic separation and identification techniques. Two 3.5-hour lab periods. HAZARD: CHCl3 - carcinogen.

*ANAL INORG QUAL SOLUB 3 HAZARD

Separation of Mn and Zn from Co and Ni by Fractional Dissolution of Their Sulfides
Hahn, R. B.; Sanders, C. H.; Gutnikov, G.
J. Chem. Educ. 37 ,412 (1960)
The combined sulfides of Mn^{++}, Zn^{++}, Co^{++} and Ni^{++} are treated (1) with 1M HOAc, which dissolves out the Mn^{++}, (2) 2M HCl, which dissolves out the zinc (* small quant. of the other two ions). Separation and identification scheme given for the three resulting solutions. HAZARD: thioacetamide is a carcinogen.

*ANAL CHROMATOG DISTRIB ENVIRON GC PESTICIDE 4

DDE Levels in Birds: An environmentally oriented undergraduate experiment
Hall, S.; Reichardt, P. B.
J. Chem. Educ. 51 ,684 (1974)
Intended for an environmental chemistry course. A technique experiment acetone/hexane extraction using Soxhlet extractor; column chromatography uses Celite column; flame ionization GC. Warning: toxic compounds.

*ANAL INSTR TECHNIQUE UVIS 4

The Principles of Flow Injection Analysis as Demonstrated by Three Lab Exercises
Hansen, E. H.; Ruzika, J.
J. Chem. Educ. 56 ,677 (1979)
State-of-the-art automated procedures. 1) phosphate by formation of phosphomolybdenum blue, 2) chloride in sea water, 3) HCl by a "titration" procedure. Spectroscopic detection. Detailed presentation.

*ANAL PHYS ACBA APPARATUS HEAT TITN 4

A Thermometric Titration Experiment for Analytical and Physical Chemistry
Hansen, L. D.; Kenney, D.; Litchman, W. M.; Lewis, E. A.
J. Chem. Educ. 48 ,851 (1971)
Titration, with a strong acid, of mixtures of tris-(hydroxymethyl)amino-methane and pyridine. Constant rate buret, recording Wheatstone bridge.

*ANAL INORG DISTRIB QUAL 2 HAZARD

Chloride, Bromide, and Iodide Determination
Hanson, M. W.
J. Chem. Educ. 38 ,412 (1961)
By oxidation to the free elements I2 and Br2 with a) dilute and b) more concentrated HNO3. The elements are then extracted from the aq. layer with CCl4. NOTE from Stony Brook: we found that this oxidation does not work well enough for use in qual.anal. HAZARD: CCl4 - replace with CH2Cl2.

*ANAL INSTR UVIS 4

Simultaneous Spectrophotometric Analysis of a Three-Component Mixture : An experiment for Instrumental Analysis
Harker, G. G.; Huntington, J. L., Jr.; Gruber, T. A.; Hargis, L. G.
J. Chem. Educ. 47 ,712 (1970)
Beckman DU; o-, m-, and p- cresols. Caution: all three cresols can attack skin and produce serious poisoning symptoms, such as loss of sensation. Wear gloves. Study questions given.

*ANAL STOICH TITN 3

The Barium Hydroxide-Ammonium Thiocyanate Reaction. A Titrimetric Continuous Variations Experiment.
Harris, A. D.
J. Chem. Educ. 56 ,477 (1979)
Barium hydroxide and ammonium thiocyanate react spontaneously in the solid state to yield ammonium hydroxide which decomposes to ammonia and water. The ammonia is collected in boric acid and titrated with standard HCl, as in the classical Kjeldahl method. Simple apparatus for ensuring quantitative recovery of the ammonia described.

*ANAL INORG DTA GRAVIM STOICH 2

Decomposition of Copper(II) Sulfate Pentahydrate
Harris, A. D.; Kalbus, L. H.
J. Chem. Educ. 56 ,417 (1979)
Stepwise removal of bound water, ignition to cupric oxide. Requires 400 deg. Celsius furnace.

*ANAL CONSUMERPROD DEMO PAPERC 2

Paper Disc Chromatography
Hart, H.
J. Chem. Educ. 36 ,A50 (1959)
Chem-Ed Tested Demo. Rapid separation of food colorings.

*ANAL INSTR REFRACT 3

Qualitative Analysis of Xylene Mixtures by Refractometry
Hartkopf, A.; Schroeder, R. R.; Meyers, C. H.
J. Chem. Educ. 51 ,405 (1974)
Refractometry used in conjunction with IR. Sraightforward.

*ANAL QUAL 2

A New Single-Solution Confirmatory Test for Nitrite Ion
Hawthorne, R. M., Jr.; Ruthenberg, M. J.
J. Chem. Educ. 55 ,29 (1978)
A few drops of 1% aq. mercaptoacetic acid added to 1/2-ml sample of 1% sodium nitrite causes immediate development of characteristic salmon-pink color. Non-toxic, but has a mild hydrogen sulfide-like odor.

*ANAL ORG PAPERC 3 HAZARD

Quick Paper Chromatography of Amino Acids
Heimer, E. P.
J. Chem. Educ. 49 ,547 (1972)
Acetonitrile/ammonium acetate, ninhydrin. Develop in 40 min. Rf values for 11 amino acids given. Author gives level as grad/undergrad.
Hazard: ninhydrin is a suspected carcinogen.

*ANAL ORG NATPROD TLC 3

TLC Monitoring of Triglyceride Saponifiction
Heller, R. A.
J. Chem. Educ. 53 ,778 (1976)
Saponifiction of edible fat or oil followed by removing samples periodically and analyzing by TLC. A single spot gives way to multiple spots indicating formation of the di-, and mono-glyceride, and the free acid. The intermediate products disappear and the TLC plates eventually show only one spot (free acid). Silica plate, hexane/ ethyl ether/HOAc developer, visualization by dichlorofluorescein under UV. Rf values given.

*ANAL COMPUTER FLUOR 5 HAZARD

The Effects of Absorption and Self-Absorption Quenching on Fluorescent Intensities
Henderson, G.
J. Chem. Educ. 54 ,57 (1977)
2,3-Butanedione in CCl4 gives fluorescence excitation spectra, measured spectrophotofluorometer and computer analyzed for self-absorption.
Hazard--CCl4 is a carcinogen; substitute another solvent.

*ANAL COMPUTER INSTR NMR 5 HAZARD

An NMR-Spectrophotometer Interface Experiment: Demonstrating How Signal Averaging Influences Signal-to-Noise Ratios
Henner, M.; Levoir, P.; Ancian, B.
J. Chem. Educ. 56 ,684 (1979)
A simple interface system is described. Interface block diagram, command unit, flow diagram given. 1% ethylbenzene in CCl4 (HAZARD: carcinogen).

*ANAL GRAVIM 2

Gravimetric Determination of Calcium as $CaC_2O_4 \cdot H_2O$
Henrickson, C. H.; Robinson, P. R.
J. Chem. Educ. 56 ,341 (1979)
Complete instructions. Suitable for large classes.

*ANAL INORG REDOX TITN 2

Oxidation State Determinations for Some Reaction Products of Vanadium(V). A Multicolored Titration
Hentz, F. C., Jr.; Long, G. G.
J. Chem. Educ. 55 ,55 (1978)
Multiple oxidation states; Zn-Hg and Fe(+2) reductions. Permanganate titrations. Starting material: ammonium metavanadate.

*ANAL GRAVIM HANDICAPPED TITN 2

A General Chemistry Experiment for the Blind
Hiemenz, P. C.; Pfeiffer, E.
J. Chem. Educ. 49 ,263 (1972)
The blind can use a triple-beam balance. An apparatus for conductometric titration was modified to produce an audible signal. The two techniques, taken together, allowed a blind student to determine the molecular weight of an unknown acid (trichloroacetic).

*ANAL ACBA ELECTROANAL NONAQ TITN 4 HAZARD

A Nonaqueous Conductimetric Titration for the Analysis of Alkaloids in Cigarette Tobacco
Hiller, J. M.; Mohan, M. S.; Brand, M. J.
J. Chem. Educ. 56 ,207 (1979)
Conductimetric titn. in glacial acetic acid medium. Caution: skin irritants, toxic extract. Hazards: $HClO_4$ is a storage hazard; CCl_4 is carcinogenic; substitute another solvent.

*ANAL COORD DISTRIB UVIS 4 HAZARD

Iron(III) Determination Using Liquid-Liquid Extraction and Colorimetry
Holt, R. L.; Easley, W. K.
J. Chem. Educ. 42 ,276 (1963)
8-Hydroxyquinoline (oxime) extraction is followed by direct colorimetric detn. of complex. Hazard: chloroform (solvent) is a carcinogen.

*ANAL AA INSTR 4

An Atomic Absorption Interferences Experiment: An Advanced Exercise for the Undergraduate Analytical Laboratory
Hosking, J. W.; Snell, N. B.; Sturman, B. T.
J. Chem. Educ. 54 ,128 (1977)
Effect of variables in calcium analysis. Detecting and overcoming interferences (Al, Mg, Cl-, PO4(-3), Sr, Na, La). Four 3-hr. lab periods.

*ANAL COORD PHOTO UVIS 3 HAZARD

A Simple Method for the Analysis of Cobalt in Co(III) Complexes
Hughes, R. G.; Endicott, J. F.; Hoffman, M. Z.; House, D. A.
J. Chem. Educ. 46 ,440 (1969)
Mercury lamp photolysis or boiling with K2S2O7 gives Co(II), determined colorimetrically. WARNINGS; UV radiation, ozone evolution, HClO4 (storage hazard), Co(III) complexes may decompose violently on heating.

*ANAL ORG TLC UVIS 3

TLC Separation and Spectrophotometric Analysis of o- and p-Nitroaniline
Hurlbut, J. A.
J. Chem. Educ. 48 ,411 (1971)
Preparative TLC; silica plates; moving phase is ethyl acetate. Abs. maxima and Rf values given. Two 3-hr. lab periods. Caution: both amines are toxic and absorb through skin.

*ANAL AA NOPROC 3

Determination of Trace Quantities of Chromium and Manganese in Steel, Ore, and Liquid Samples by Atomic Absorption Spectrometry
Hurlbut, J. A.; Gilbert, L. K.; Buddington, B. N.; Rees, T. F.
J. Chem. Educ. 71 ,734 (1974)
Note describes successful use of AA in analysis of steel, etc., for chromium and manganese. Two 3-hr. lab periods.

*ANAL INORG QUAL 3 HAZARD

Identification of Copper and Cadmium: A method without the use of KCN
Husted, H. G.
J. Chem. Educ. 35 ,403 (1958)
Advantage is taken of the amphoteric nature of cupric hydroxide to separate it from Cd(OH)2 which is not amphoteric. 8M NaOH. Copper is identified as the ferrocyanide, cadmium as the sulfide. HAZARD: avoid cadmium.

*ANAL QUAL 2

The Detection of Strontium and Calcium
Isenberg, N.; Collins, C.; Strax, P.; MacFarland, S. A.
J. Chem. Educ. 39 ,401 (1962)
Short note suggests removal of any chromate as Ag2CrO4, and excess Ag^+ as AgCl before precipitating oxalates. This is to prevent darkening of triethanolamine used in the Sr/Ca separation.

*ANAL QUAL 2 HAZARD

Errors in the Detection of Cadmium: Light-colored copper-thioacetamide complexes
Isenberg, N.; Kreger, H. J.; Middleton, R. H.
J. Chem. Educ. 43 ,422 (1966)
Cautions that metal complexes with thiourea may give false positive cadmium test. HAZARD: thiourea is a suspected carcinogenic.

*ANAL INORG QUAL 3 HAZARD

Analysis of Mercury(II) Salts With Thioacetamide
Isenberg, N.; Perlman, E.; Puryear, R.; Sparks, S. A.
J. Chem. Educ. 35 ,404 (1958)
A note reporting that the orange HgS precipitated by thioacetamide does not differ from the ordinary black ppt with H2S, as far as the qual. scheme is concerned. HAZARD: thioacetamide is a carcinogen.

*ANAL ORG CATALYSIS GEOM UVIS 4

Quantitative Analysis by Ultraviolet Spectroscopy of the cis trans Stilbene System
Ish-Shalom, M.; Fitzpatrick, J. D.; Orchin, M.
J. Chem. Educ. 34 ,496 (1957)
Selenium (0.1 percent) at 210 degrees C, analysis by UV (Beckman DU).

*ANAL BIOCHEM PAPERC 3

Quick Paper Chromatography of Monosaccharides
Ivany, J. W. G.; Heimer, E. P.
J. Chem. Educ. 50 ,562 (1973)
Devised for beginning biochem lab. R(glucose) values for 21 monosaccharides. Acetonitrile-aq.NH4OAc soln. at pH 7 gives resolution in 1 hour.

*ANAL PHYS ELECTROANAL TITN 4

An Undergraduate Electroanalytical Experiment
Janata, J.
J. Chem. Educ. 53 ,399 (1976)
Determination of vanillin by amperometric titration with standard 2,4-dinitrophenylhydrazine; dropping mercury electrode.

*ANAL ELECTROANAL 3

Potentiometric Determination of Mixed Halides
Jaques, D.
J. Chem. Educ. 42 ,429 (1965)
AgNO3/iodide, bromide, chloride. Unknown, potentiometric titration.

*ANAL COLUMNC DISTRIB GC PESTICIDE PROJ TLC 4 HAZARD

The Determination of Pesticide Residues
Jarosch, R.
J. Chem. Educ. 50 ,507 (1973)
Florisil column for preliminary purification. Separation: TLC (silica gel). Visualization: Rhodamine-B (Rf values given), or GC (electron capture). Fish, soil, etc. samples. HAZARDS: carcinogens: CCl4,CHCl3, and benzene; Warning: pesticides are extremely toxic.

*ANAL QUAL 3

Neothorin Spot Test for Zirconium and Hafnium
Johnson, A. R., Jr.
J. Chem. Educ. 42 ,439 (1965)
Neothorin is almost specific for Zr and Hf. Explicit procedures for spot tests.

*ANAL DEMO EDTA REVIEW TITN 4

EDTA and Complex Formation
Johnston, M. B.; Barnard, A. J., Jr.; Flaschka, H. A.
J. Chem. Educ. 35 ,601 (1958)
Nine experiments involving EDTA titrations developed to illustrate the use of this reagent. Explicit directions both for the titrations and for the preparation of the necessary solutions. 18 references.

*ANAL INORG QUAL 2

A New Qualitative Reagent for Aluminum
Jones, C. T.; Williams, M. B.
J. Chem. Educ. 38 ,411 (1961)
Arsenazo,3-(2-arsonophenylazo)-4,5-dihydroxy-2,7-naphthalenedisulfonic acid, gives a reddish-purple coloration with Al^{+++}.

*ANAL COORD CRYSTAL GRAVIM 4

Precipitation from Mixed Solvents: A Demonstration
Jones, J. L.
J. Chem. Educ. 45 ,433 (1968)
Ni(DMG)2 shows various crystal habits depending on conditions of precipitation. Not a lecture demo.

*ANAL UVIS 2

A Simple Practical Lab Test For Freshman Students
Jones, M. M.
J. Chem. Educ. 54 ,178 (1977)
Student prepares a K2CrO4 solution by accurate weighing and dilution. Instr. measures abs. 475 nm.

*ANAL ACBA DISTRIB TITN 2 3

A Simple Liquid-Liquid Extraction Experiment for Freshmen
Jones, M. M.; Champion, G. R.
J. Chem. Educ. 55 ,119 (1978)
n-Amyl alcohol-water-salicylic acid. Explicit procedure. Anal. by tit'n. Toxicities of compounds used given; none are very toxic.

*ANAL INORG QUAL 2

Spot Test for Detection of Manganese
Kadarmandalgi, S. G.
J. Chem. Educ. 41 ,437 (1964)
Resacetophenone reagent (prep not given) suggested in qualitative analysis for Mn(II).

*ANAL INORG QUAL 2

Resacetophenone Oxime Chelation of Copper in the Presence of Cadmium
Kadarmandalgi, S. G.
J. Chem. Educ. 41 ,438 (1964)
Improved separation of copper from cadmium without use of cyanide. Use is made of a new reagent, a derivtive of resorcinol (prep not given).

*ANAL ACBA STOICH TITN 3

A Multifaceted Experiment for Quantitative Analysis: Back Titration, Hydroxide Determination, and Selection of an Indicator
Kalbus, L. H.; Petrucci, R. H.; Kalbus, G. E.
J. Chem. Educ. 53 ,719 (1976)
Determination of the hydroxide concentration of basic copper chromate illustrates back titration, hydroxide determination, indicater selection and titration curves. Dissolve weighed basic copper chromate in an aliquot of standard acid and back-titrate with hydroxide.

*ANAL EDTA IONX 4

Separating Nd from Pr: A Laboratory Experiment in Ion-Exchange Chromatography
Kauffman, G. B.; Blank, J. S.
J. Chem. Educ. 37 ,156 (1960)
The band of lanthanides absorbed on a column of DOWEX-50W is eluted with a buffered EDTA solution through a second column of DOWEX-50W in the copper(II) form. Since the copper-EDTA complex is more stable than either Ln-EDTA complex, the second column acts as a barrier through which the Ln-EDTA complexes cannot pass without decomposition, thus enhancing the sep'n. Experimental set-up diagrammed. Complete directions.

*ANAL ELECTROANAL 3 HAZARD

Controlled Potential Electrolysis : An experiment for elementary quantitative analysis
Kennedy, J. H.; Adamo, F.
J. Chem. Educ. 47 ,461 (1970)
Diagram of cell given. Requires an integrator. Experiments performed are anodic electrolysis of (1) I-, (2) As(III), (3) Fe^{++}, and cathodic electrolysis of (4) Pb^{++} and (5) Cd^{++}. HAZARD (avoidable) - Cd^{++}

*ANAL IONX QUAL 2

Preparation of Solutions for Qualitative Analysis with a Cation Exchanger
Key, P.; Sohl, E.; Tiews, R.; Bricker, C.
J. Chem. Educ. 40 ,416 (1963)
Results of student research: (1) Ion exchange replaces carbonate pptn. in qual. proc. (2) Trap construction for ident. of sulfide and carbonate.

*ANAL BACTERIA BIOCHEM ENVIRON GRAVIM REDOX 2

A Demonstration of Bacterial Reduction of Inorganic Sulfate
Kinard, W. F.
J. Chem. Educ. 56 ,559 (1979)
Determination of sulfate in mud samples from Charleston Harbor by barium sulfate pptn. and gravimetric analysis. The amount of sulfate in these samples falls off with time due to bacterial reduction of the sulfate to sulfide.

*ANAL ENVIRON UVIS WATERCHEM 2

Nitrate Analysis: A laboratory experiment for the nonscience major course
King, D. M.; Lampman, G. M.; Smith, J. H., III
J. Chem. Educ. 48 ,647 (1971)
Brucine used to detect and estimate nitrate in fresh water. Spec-20. Caution: brucine and its derivatives are extremely toxic.

*ANAL ELECTROCHEM HPLC INSTR NATPROD 4

High Performance Liquid Chromatograph Experiments for Undergraduate Laboratories
Kissinger, P. T.; Felice, L. J.; King, W. P.; Pachla, L. A.; Riggin, R. Shoup, R. E.;
J. Chem. Educ. 54 ,50 (1977)
Liquid chromatography/electrochemical (amperometric) detection constructed. Preliminary purification and determination of ascorbic acid, uric acid, acetaminophen, etc. Very detailed procedure.

*ANAL ORG QUAL 3

The Detection of Carboxylic Acids by Formation of Ferric Hydroxamates : An improved method
Knight, D. W.; Cleland, G. H.
J. Chem. Educ. 47 ,781 (1970)
Data collection; variation on a method for qual. test for carboxylic acids. Reagents are thionyl chloride, hydroxylamine hydrochloride, pyridine and ferric chloride.

*ANAL ORG COMPUTER GC TECHNIQUE 3

Mixed Stationary Liquid Phases for Gas-Liquid Chromatography
Koury, A. M.; Parcher, J. F.
J. Chem. Educ. 56 ,623 (1979)
Use of "window diagrams" to predict effectiveness of mixed bed columns (2 component liq. phase). Exercise in selection of liquid phase in GC. Experiment is the measurement of retention time of several components on two single liquid phase (polar and non polar) columns. Construct window diagrams (can be computer aided), then preparation of mixed bed colunm, and separation of a mixture. Requires pure liquid phase, and components.

*ANAL GRAVIM NONAQ TITN UVIS 3

A Nonaqueous Gravimetric Titration. Determination of 8-hydroxyquinoline with p-Toluenesulfonic Acid in Acetonitrile
Kratochvil, B.; Findlay, E. J.; Harris, W. E.
J. Chem. Educ. 50 629 (1973)
Spec-20, syringe, detailed procedure given.

*ANAL CONSUMERPROD ENVIRON QUAL 1

Analysis of Phosphates in Detergents
Kriz, G. S.; Kriz, K. D.
J. Chem. Educ. 48 ,551 (1971)
Pptn as ammonium phosphomolybdate. Designed for non-science students. Discussion.

*ANAL CONSUMERPROD EDTA TITN 2

Determination of Percent Na(EDTA) in Bathroom Cleaners
Kump, K. L.; Palocsay, F. A.; Gallaher, T. N.
J. Chem. Educ. 55 ,265 (1978)
Titn. with std. Mg(+2) soln./Eriochrome Black-T.

*ANAL COORD EDTA PH TITN UVIS 3

Turbimetric Determination of Chelated Calcium at Various pH Levels: An Analytical Laboratory Experiment
L'Annunziata, M. F.; Fuller, W.
J. Chem. Educ. 46 ,172 (1969)
Excess Ca^{++} from titn. of EDTA ppts. as oxalate yielding turbidity. Abs. at 330 nm. measures turbidity.

*ANAL INORG QUAL 2

A Simple Method for the Detection of Soluble Bicarbonates
Lahiri, A. G.
J. Chem. Educ. 35 ,298 (1958)
Rapid test for soluble bicarbonate using a suspension of HgO in sat'd NaCl solution.

*ANAL QUAL 3

Some Analytical Reagents for Tin(II)-Tin(IV) Mixtures
Lal, S.; Srivastava, S. N.
J. Chem. Educ. 44 ,481 (1967)
Spot tests. Uses inorganic reagents, dyes.

*ANAL QUAL 3

Detection of Mercury(I) and Mercury(II) in the Presence of Each Other
Lal, S.; Srivastava, S. N.
J. Chem. Educ. 44 ,482 (1967)
Spot tests. Uses four different reagents; some are now known to be carcinogens.

*ANAL QUAL 3

Reagents for Analysis of Iron(II)-Iron(III) Mixtures
Lal, S.; Srivastava, S. N.
J. Chem. Educ. 44 ,482 (1967)
Spot tests. Uses three different reagents. Caution: Alpha-nitroso-beta-naphthol is a carcinogen and NH4F is extremely toxic.

*ANAL ENVIRON QUAL 2 HAZARD

A Simple Qualitative Analysis Scheme for Several Environmentally Important Elements
Lambert, J. L.; Meloan, C. E
J. Chem. Educ. 54 ,249 (1977)
Short scheme for separation and identification of 12 ecologically important cations provides "hands on" experience with qual anal. Hazard: cadmium, should be omitted. No sulfides or cyanides. Detailed.

*ANAL CONSUMERPROD ENVIRON IONSELECT WATERCHEM 4

Laboratory Experiments with Ion Selective Electrodes
Lamb, R. E.; Natusch, D. F. S.; O'Reilly, J. E.; Watkins, N.
J. Chem. Educ. 50 ,432 (1973)
Commercial ion selective electrode, pH meter or electrometer to 0.1 mV. Natural waters, vegetation, toothpaste. Caution: fluorides are extremely toxic.

*ANAL ASPIRIN FORENSIC PHARM QUAL 1

Qualitative Identification of Narcotics by Spot Test Examination
Lampe, K. F.
J. Chem. Educ. 35 ,96 (1958)
A series of spot tests developed by the School of Medicine at the University of Miami for use by untrained (ie., in chemistry) police officers for the identification of the common narcotics. Directions for the preparation of 4 color-producing reagents (ordinary chemicals) and a chart of the color reactions.

*ANAL COMPLEX INSTR STOICH UVIS 2 HAZARD

The Use of Nephelometric Measurements to Determine the Presence of Chelates
Land, J. E.
J. Chem. Educ. 34 ,38 (1957)
Job's method of continuous variation used to determine the formula of the copper(II)-cupferron ppt. Fisher nephelo-photometer with 525 nm filter. Within capacity of most univ. freshmen, but intended for an instrumental analysis course. Hazard: CHCl3

*ANAL TECHNIQUE TITN 3

Titrimetric Determination of Sodium Salicylate in Blood: A Student Laboratory Experiment
Lane, S. R.; Stewart, J. T.
J. Chem. Educ. 51 ,588 (1974)
Diphasic titrimetry (organic solvent present) illustrates technique by titn of sodium salicylate in either whole blood or serum with a std. base. Caution: blood is an infection hazard.

*ANAL INORG PAPERC QUAL 2

Paper Chromatographic Identification of Gold, Platinum, Selenium, and Tellurium
Larsen, E.
J. Chem. Educ. 41 ,435 (1964)
Butanol, methanol, ether developer, spray detection.

*ANAL AA CONSUMERPROD 2

The Iron Content of Breakfast Cereals
Laswick, P. H.
J. Chem. Educ. 50 ,132 (1973)
Atomic absorption spectrometer, dil. HCl extraction. Cereals, breakfast food. For non-science majors.

*ANAL ORG GRAVIM NONAQ TITN 3

Piperazine as the Diacetate - An Organic Gravimetric Experiment
Latimer, G. W.
J. Chem. Educ. 43 ,148 (1966)
Unknowns; precipitate filtered in tared crucibles, dried in vacuum desiccator. Of limited application. Caution: piperazine is an irritant.

*ANAL ACBA NONAQ 3 HAZARD

The Non-Aqueous Titration of the Salts of Weak Acids
Latimer, G. W., Jr.
J. Chem. Educ. 43 ,215 (1966)
Perchloric acid (explosion and storage HAZARD), 1M in acetic acid-acetic anhydride. Crystal violet indicator.

*ANAL COLUMNC DEMO 2 HAZARD

Chromatography: Inorganic Separations Using Chalkboard Chalk
Lauren, P. M.
J. Chem. Educ. 44 ,A34 (1967)
Mixed cation solutions in test tube or beaker with chalk to permit upward migration. Develop colors by NH3, H2S. HAZARD: H2S is toxic, Cd a carcinogen.

*ANAL INORG QUAL 2

A New Short Method of Separating Lead From Bismuth Copper, and Cadmium
Lehrman, L.
J. Chem. Educ. 35 ,406 (1958)
$PbSO_4$ precipitates quantitatively on the addition of $(NH_4)_2SO_4$ to the nitric acid solution. Bi(III), Cu(II) and Cd(II) do not interfere.

*ANAL INORG QUAL 3

Semimicro Analysis of Alloys Containing Zirconium
Lehrman, L., Dorenbush, M.; Meisler, N.
J. Chem. Educ. 37 ,407 (1960)
Zirconium appears in Group III with iron and titanium in the classical qualitative analysis scheme. In the procedure given, the hydroxide ppt, which may contain Fe, Ti, or Zr is dissolved in HCl, zirconium is pptd as the arsenate from this sol'n, and det'd as its complex with Alizarin Red S. A rough estimate of the quantity of Zr can be obtained by counting the drops of 0.1M F- it takes to decolorize the sol'n.

*ANAL PHYS BIOCHEM DEMO PH 2

An Effective Demonstration of the Behavior of Indicators and Biochemicals in Buffers
Lerman, C. L.; Doyle, R. R.
J. Chem. Educ. 53 ,634 (1976)
Obs. of color of p-nitrophenol, methyl red and bromcresol green at pH 0, 4, and 10 (in HCl, and carbonate and acetate buffers).

*ANAL PHYS ACBA ELECTROANAL IONSELECT KEQ TITN 3

Potentiometric Determination of Kw With the Glass Electrode
Liberti, A.; Light, T. S.
J. Chem. Educ. 39 ,236 (1962)
HCl-NaOH titration. Ag/AgCl ref. Cell protected from CO2. Activity coefficients, liquid junction potentials.

*ANAL ASPIRIN PHARM TLC 2 HAZARD

Analysis of APC Tablets: An inexpensive and practical thin-layer chromatography experiment
Lieu, V. T.
J. Chem. Educ. 48 ,478 (1971)
Uses a large chromatog. chamber or cut a bottle, UV lamp, std. sol'ns of caffeine, phenacetin, and acetylsalicylic acid, APC tablets. HAZARD: benzene, carcinogen, substitute.

*ANAL AA APPARATUS ENVIRON 3

A Non-Flame Atomic Absorption Attachment for Trace Mercury Determination.
Lieu, V. T.; Cannon, A.; Huddleston, W. E.
J. Chem. Educ. 51 ,752 (1974)
Simple construction details given for air-sweep of sample by SnCl2 solution into quartz-window long cell.

*ANAL CONSUMERPROD ELECTROANAL IONSELECT REVIEW WATERCHEM 3

Determination of Fluoride in Toothpaste Using an Ion-Selective Electrode
Light, T. S.; Cappuccino, C. C.
J. Chem. Educ. 52 ,247 (1975)
LaF3 membrane electrode, total ionic strength adjustment buffer, potentiometer, toothpaste, city water supply. Easy measurement. Discussion of other methods, activity coefficients. Questions for discussion. Caution: fluorides are toxic.

*ANAL INORG QUAL TLC 2

A Thin-Layer Chromatography Experiment For General Chemistry
Lincoln, S.; Pohl, R. A.; Haworth, D. T.
J. Chem. Educ. 47 ,401 (1970)
Separation of inorganic cations using microcrystalline cellulose, rods, plates. Classical qual. cations. 11 spray detection reagents, solvent systems, and Rf values outlined. Unknowns.

*ANAL DISTRIB TECHNIQUE UVIS 5

Counter-Current Distribution as a Student Laboratory Experiment
Lindblad, B.; Lindstedt, G.; Tiselius, H. G.
J. Chem. Educ. 46 ,525 (1969)
Two dyes distributed between two solvents in 5 separatory funnels.

*ANAL ELECTRODE INSTR IONSELECT 4

Student Preparation and Analysis of Chloride and Calcium Ion Selective Electrodes
Lloyd, B. W.; O'Brien, F. L.; Wilson, W. D.
J. Chem. Educ. 53 ,328 (1976)
Preparation of chloride ion and calcium ion liquid ion-exchange resins in PVC matrix. Emphasis on evaluating performance characteristics of the electrode.

*ANAL GC 2

The Determination of the Alcohol Content of Beer--A General and Analytical Experiment with High Student Interest Value
Lokken, D. A.
J. Chem. Educ. 52 ,329 (1975)
Quantitave GC by peak height ratios with added propanol as internal standard
One 3-hr. lab period.

*ANAL CONSUMERPROD TITN 2

Mercurimetric Determination of Chloride in "Lite" Salt.
A Freshman Chemistry Experiment
Long, G. G.; Hentz, F. C., Jr.
J. Chem. Educ. 52 ,714 (1975)
Mixed KCl and NaCl analyzed. Indicator: diphenylcarbazone. RPI suggestion: diphenylthiocarbazone may be substituted for diphenylcarbazone.
"Lite" is a registered trademark.

*ANAL BIOCHEM DISTRIB GC NATPROD 4 HAZARD

Analysis of Lipid Content of Ground Beef: An Undergraduate Biochemistry Experiment
Long, G. L.
J. Chem. Educ. 52 ,813 (1975)
Samples injected as methyl esters. Methylating agent not specified.
Hazard: chloroform is a carcinogen; use a substitute.

*ANAL ORG TECHNIQUE 3 HAZARD

Oxygen Flask Semimicro Methods for Organic Sulfur and Phosphorus
MacDonald, A. M. G.; Stephen, W. I.
J. Chem. Educ. 39 ,528 (1962)
Modifications of titrations following oxygen flask combustion. Uses barium perchlorate for sulfate, and molybdate for phosphorus. HAZARD: 50% HClO4 used in rgnt prep, is a strong oxidant and explosive hazard.

*ANAL COMPUTER ELECTROANAL STATISTICS 4

Computer Evaluation of Titrations by Gran's Method: An analytical chemistry experiment
MacDonald, T. J.; Barker, B. J.; Caruso, J. A.
J. Chem. Educ. 49 ,200 (1972)
Computer-evaluation of data from potentiometric titration of Fe^{+2} with Ce(IV). This is not an interfacing experiment.

*ANAL GRAVIM STATISTICS 2

A "Relevant" First Experiment for Freshman Chemistry Laboratory
Macomber, R. S.
J. Chem. Educ. 49 ,714 (1972)
Popcorn weighed on an analytical balance before and after popping. This is a "first experiment" designed to teach analytical balance. Some statistial analysis.

*ANAL INORG UVIS 3

Simultaneous Spectrophotometric Determination of Cobalt and Chromium: A Student Experiment
MacQueen, J. T.; Knight, S. B.; Reilley, C. N.
J. Chem. Educ. 37 ,139 (1960)
Vis. spectrophotometer. Aq. nitrate solutions. Very time-consuming if recording spectrometer is not available.

*ANAL ASPIRIN PHARM TLC 3 HAZARD

Thin Layer Chromatogram Visualization
Madsen, B. C.
J. Chem. Educ. 50 ,852 (1973)
Silica gel containing a 254 nm phosphor. Rf values given for 12 common analgesics. Hazard: benzene is a carcinogen; use a substitute.

*ANAL PAPERC QUAL 2

A Rapid Paper Chromatographic Analysis of Group I Cations
Marion, S. P.; Psihas, J.
J. Chem. Educ. 34 ,87 (1957)
A short note to describe use of paper chromatography to separate the ions of the Group I cations, so that advantage may be taken of the different colors of their chromates for identification.

*ANAL INORG QUAL 3

A Spot Test Analysis of the Group III Cations
Marion, S. P.; Zlochower, I.
J. Chem. Educ. 36 ,379 (1959)
From the "Notes on Qual" column. Ni by DMG, Fe(III) by SCN-, Co by alpha-nitroso-beta-naphthol, Al by alizarin, Mn by bismuthate, Cr(III) by diphenylcarbazide and Zn by dithizone. Warning: many of these reagents are now known to be carcinogens.

*ANAL ORG ELECTROANAL KIN 4

Determination of Carbonyl Mixtures by a Differential Reaction Rate Method
Mark, H. B., Jr.; Greinke, R. A.
J. Chem. Educ. 46 ,869 (1969)
Change in conductance with time in reaction of carbonyl compound and hydroxylamine hydrochloride, for standard and unknown plus standard in two different solvent systems gives composition.

*ANAL COLUMNC 3 HAZARD

Column Chromatography Experiment Using Unknowns
Marmor, S.
J. Chem. Educ. 42 ,272 (1965)
Typical column chromatog. (but substitute for benzene eluant - HAZARD: carcinogen), except that colorless unknowns are used.

*ANAL ELECTROANAL TITN VITAMIN 2

Analysis of Commercial Vitamin C Tablets by Iodometric and Coulometric Titrimetry
Marsh, D. G.; Jacobs, D. L.; Veening, H.
J. Chem. Educ. 50 ,626 (1973)
Procedures by reference. Detector circuit for endpoint given.

*ANAL STOICH 2 HAZARD

An Experiment for Introductory College Chemistry: How to Establish a Chemistry Equation
Masaguer, J. R.; Coto, M. V.; Casas, J. S.
J. Chem. Educ. 52 ,387 (1975)
Method of continuous variation. $BaCl_2$ + K_2CrO_4. Output parameter is height of ppt. in test tube. Hazard: Cr(VI) compounds are carcinogens.

*ANAL INORG GAS 2

Analysis of an Aluminum-Zinc Alloy
Masterton, W. L.
J. Chem. Educ. 38 ,558 (1961)
The old "equivalent weight of a metal" by measuring hydrogen evolved modified here by preparing alloys, analyzing composition.

*ANAL ENVIRON TITN WATERCHEM 2

The Determination of Dissolved Oxygen by the Winkler Method: A Student Laboratory Experiment
McCormick, P. G.
J. Chem. Educ. 49 ,839 (1972)
Iodimetry. O_2 absorber: basic Mn(II). 60-ml plastic syringe. Natural waters.

*ANAL EDTA NATPROD TITN 2

Titration of Calcium and Magnesium in Milk with EDTA
McCormick, P. G.
J. Chem. Educ. 50 ,136 (1973)
Mg indicator: calmagite. Ca indicator: hydroxy naphthol blue. Somewhat more challenging than water analysis.

*ANAL QUAL 2

Qualitative Tests for K^+
McCoy, R. E.
J. Chem. Educ. 42 ,444 (1965)
Corrects lab directions for confirming test for potassium ion after precipitation as potassium cobaltinitrite. Cobalt interferes.

*ANAL NATPROD PAPERC 2

Sour Grapes - Why Are They?
McCullough, T.
J. Chem. Educ. 55 ,264 (1978)
Analysis of green and ripe grapes by paper chromatography. Solvent is ethyl acetate/ formic acid/ water: visualization by spraying with dichlorofluorescein in 1-propanol.

*ANAL ORG ACBA GRAVIM PAPERC TITN 3

A Combined Gravimetric-Volumetric Analysis for Organic Chemistry
McCullough, T.
J. Chem. Educ. 51 ,279 (1974)
Unknown mixture of 2 simple organic acids. One is formic, determined by oxidation with mercury(II) chloride (gravimetric: mercury(I) chloride). Neutral equivalent of mixture by acid-base. Paper chromatog.

*ANAL ORG PAPERC QUAL 3

Detection of Chloride, Bromide, and Iodide Following Sodium Fusion
McCullough, T.; Allaire, P. N.; Boettcher, B. R.
J. Chem. Educ. 47 ,217 (1970)
Solvent: acetone-water. Visualization by dichlorofluorescein, $AgNO_3$.

*ANAL BIOCHEM PAPERC 2

A Short, Intensive Experiment in Paper Chromatography
McCullough, T.; Lechtenberg, A.
J. Chem. Educ. 47 ,141 (1970)
Amino acids. Improved developer (fast): EtOAc-formic acid-water. Some Rf values given.

*ANAL ORG CONSUMERPROD TLC 2 HAZARD

Detection of Butylated Hydroxyanisole (BHA) in Cooking Oils
McKone, H. T.
J. Chem. Educ. 53 ,800 (1976)
Intended for non-science majors. BHA is separated from a cooking oil in hexane sample by extraction with ethanol and extract analyzed by TLC. Silica plate, chloroform developer, visualization with ethanolic phosphomolybdic acid + ammonia gas. HAZARD: chloroform is carcinogenic; substitute ethyl acetate (?), dichloromethane (?).

*ANAL ORG CHROMATOG NATPROD TLC 3

The Rapid Isolation of Carotenoids from Food
McKone, H. T.
J. Chem. Educ. 56 ,676 (1979)
An easier, shorter, less hazardous and more effective method for isolating pigments from tomato paste, strained carrots, and citrus skins, for TLC analysis in undergraduate instruction, is described.

*ANAL ORG CONSUMERPROD HPLC 3

High Performance Liquid Chromatography of Essential Oils
McKone, H. T.
J. Chem. Educ. 56 ,698 (1979)
LC used to upgrade popular experiment on steam distillation of essential oils from grocery-store spices.

*ANAL COLOR CONSUMERPROD TLC UVIS 2

Identification of FD&C Dyes by Visible Spectoscopy: A Consumer-Oriented Undergraduate Experiment
McKone, H. T.
J. Chem. Educ. 54 ,376 (1977)
Recording spectrophotometer. Extraction procedure by ref. Mixed food colors separated by silica gel TLC and elution. Absorption maxima for 11 food colors given.

*ANAL ORG COLOR CONSUMERPROD TLC 2

Separation and Identification of some FD&C Dyes by TLC. An Undergraduate Laboratory Experiment.
McKone, H. T.; Nelson, G. J.
J. Chem. Educ. 53 ,722 (1976)
Jello dyes. Silica plates. 1-Butanol/ethanol/ammonia/water developer.

*ANAL APPARATUS BIOCHEM NATPROD 3

Protein Nitrogen in Fruits, Vegetables, and Meats by a Modified Kjeldahl Method: A quantitative analysis experiment
Meloan, C. E.
J. Chem. Educ. 39 ,365 (1962)
Glass blowing required. Water content by azeotropic distillation. Normal Kjeldahl except steam distillation and modified apparatus.

*ANAL SOLUB 3

Pyrosulfate Fusion of Iron Ore: A quantitative analysis experiment
Meloan, C. E.
J. Chem. Educ. 39 ,553 (1962)
Preliminary treatment of iron ore before analysis. No special apparatus.

*ANAL COLOR QUAL 2

Sodium Silicate Bead Tests in Qualitative Analysis
Midgley, C. P.
J. Chem. Educ. 44 ,483 (1967)
Without heating, mixing of sodium silicate solutions with transition metal ions as salts gives characteristic color. Substitutes for borax bead test.

*ANAL ENVIRON FLUOR WATERCHEM 2

Fluorimetric Analysis of Nitrate in Real Samples
Miguel, A. H.; Braun, R. D.
J. Chem. Educ. 51 ,682 (1974)
Spectrofluorimeter, quartz cell, fluorescein. Analysis of soil, river water, fertilizer samples. Requires work with approx. 50 ml of conc. sulfuric acid. Caution: conc. H_2SO_4 is a health hazard (burns).

*ANAL GC INSTR 3

Dual Column Gas Chromatography: A teaching tool
Miller, J. M.
J. Chem. Educ. 41 ,413 (1964)
Use of two different columns in a dual column gc shows effects or retention time, loading, homologous series.

*ANAL CONSUMERPROD UVIS 2

An Introductory Experiment on Phosphates in Detergents
Mohrig, J. R.
J. Chem. Educ. 49 ,15 (1972)
Spec-20. Two methods: (1) vanadomolybdic, (2) molybdenum blue formation. Reagents: ammonium molybdate and vanadate, 1-amino-2-naphthol-4-sulfonic acid (an antifoaming agent). Commercial detergents.

*ANAL INORG CORROSION QUAL REDOX 2

Additional Reactions of the Ferroxyl Indicator
Myers, R. T.; Falcone, R. E.
J. Chem. Educ. 49 ,599 (1972)
Ferroxyl reagent = K3Fe(CN)6 + phenolphthalein in agar gel. There is slow diffusion, allowing study of slow reactions by colors of zones and changes with time. Article describes simple iron corrosion study.

*ANAL BIOCHEM CHROMATOG IONX NATPROD PROJ TLC UVIS 3

Laboratory Experiments Using Nicotine
Navari, R. M.
J. Chem. Educ. 51 ,748 (1974)
Determination of nicotine in tobacco, blood, and urine. Caution: blood is an infection hazard, and pure nicotine is highly toxic and absorbs through the skin. Detailed presentation.

*ANAL QUAL 2

Dodecyl Sodium Sulfate as a Reagent for the Detection of Potassium
Neman, R. L.
J. Chem. Educ. 44 ,479 (1967)
Potassium salt is sufficiently insoluble to be used as a qual. test for potassium ion. Modified Group V scheme.

*ANAL PHARM TLC 4

The Thin-Layer Chromatography of Drugs: A Laboratory Experiment
Neman, R. L.
J. Chem. Educ. 49 ,834 (1972)
Explicit procedure. Methadone, morphine, barbituates analyzed by silica gel TLC. Visualization by UV and spraying with iodoplatinate and ammoniacal AgNO3. (Caution: storage hazard). Study questions. Warning: controlled substances.

*ANAL ORG GC PHARM 3

Gas-Liquid Chromatography of Derivatized Barbiturates
Novotny, M.; Bartle, K. D.
J. Chem. Educ. 51 ,333 (1974)
Methylating agent: trimethylanilinium hydroxide. Hewlett-Packard #700/HC. Caution: controlled substances.

*ANAL DRYLAB FLUOR INSTR QUANTUM 4

Quinine Fluorescence Spectra: A Dry-lab Spectral Analysis Experiment
O'Reilly, J. E.
J. Chem. Educ. 53 ,191 (1976)
Experiment consists in assigning the various peaks in the spectra to some basic physical, chemical or instrumental cause. Students are provided with excitation and emission spectra of quinine in dil. sulfuric acid.

*ANAL CONSUMERPROD FLUOR NATPROD 2

Fluorescent Experiments with Quinine
O'Reilly, J. E.
J. Chem. Educ. 52 ,610 (1975)
Spectrophotometer. Quinine in soft drinks, urine, etc. Straightforward.

*ANAL CONSUMERPROD IONSELECT 4

Determination of Iodide in Milk with an Ion Selective Electrode
O'Reilly, J. E.
J. Chem. Educ. 56 ,279 (1979)
Method of standard additions. Electrodes are slow to equilibrate at low concentration.

*ANAL EDTA TITN UVIS 4

Automated Spectrophotometric Titrations
Olsen, E. D.; Foreback, C. C.
J. Chem. Educ. 49 ,206 (1972)
EDTA titration of Ba^{++}, Cu^{++}, Sb^{+3}, Fe^{+3} to Eriochrome Black T with a titrator made from a Spec-20, drop-counter and recorder.

*ANAL BIOCHEM IONX NATPROD QUAL WATERCHEM 2

Semi-micro Ion-exchange in the Freshman Laboratory
Olson, M. V.; Crawford, J. M.
J. Chem. Educ. 52 ,546 (1975)
Biorad #731-1220 disposable columns (reusable). Blood, plasma, sea water, std. quant. unkns. Caution: blood is an infection hazard.

*ANAL APPARATUS ENVIRON GRAVIM UVIS 2

The Determination of Nitrogen Oxide and Particulates in Cigaret Smoke: A Student Laboratory Experiment
Ondrus, M. G.
J. Chem. Educ. 56 ,551 (1979)
Cigaret smoke is sampled using a membrane filter and large syringe. Particulates determined by increase in weight of filter; nitrogen oxides by reaction with sulfanilic acid and N-(1-naphthyl)ethylenediamine forming a pink color which can be determined spectrophotometrically. Spec-20. Standard nitrite solution.

*ANAL GC QUANT 3 HAZARD

Quantitative Gas Chromatography Using Peak Heights and Relative Response Factors: An Undergraduate Student Experiment
Pacer, R. A.
J. Chem. Educ. 53 ,592 (1976)
Toluene, benzene and p-xylene mixtures chromatographed under conditions which give sharp, well-defined peaks, to determine relative response factors. From this calibration, unknown mixtures may be analyzed. 1% accuracy reported. HAZARD: avoid benzene.

*ANAL DISTRIB UVIS 3

A Laboratory Experiment with Dyes to Illustrate Countercurrent Distribution
Padilla, B. A.; Herran, J.
J. Chem. Educ. 39 ,539 (1962)
Countercurrent distribution illustrated with 6 separatory funnels, phenol red and bromcresol green, water-1-butanol and sodium carbonate. Or with 29 funnels and colorimeter.

*ANAL PHYS APPARATUS BIOCHEM ENZYME KIN REDOX 4

Reaction Rate Analysis and Instrumentation: An experiment for the analytical laboratory
Pardue, H. L.; Burke, M. F.; Jones, D. O.
J. Chem. Educ. 44 ,684 (1967)
Determination of glucose by enzymatic oxidation yielding H_2O_2, which is detd iodometrically. Requires special stirred cell and monitoring current of rotating platinum electrode. Reader (DT) points out reaction is
$RCHO + O_2 + H_2O = RCOOH + H_2O_2$

*ANAL DISTRIB 3 HAZARD

Cupferron as a Reagent in Quantitative Analysis
Parks, A. O.; DuBose, B.
J. Chem. Educ. 46 ,768 (1969)
Experiment devised before cupferron/$CHCl_3$ extraction was known to be a health hazard (carcinogen).

*ANAL INORG QUAL REVIEW 2

Qualitative Test for Potassium Using Sodium Tetraphenylboron
Paul, A. D.; Gibson, J. A., Jr.
J. Chem. Educ. 36 ,380 (1959)
Research report. The reagent is claimed to be superior to cobaltinitrite for student use. 22 references.

*ANAL QUAL 2

Detection of Chloride Ion in the Presence of Bromide, Iodide, and Thiocyanate Ions
Paul, A. D.; Gibson, J. A., Jr.
J. Chem. Educ. 42 ,440 (1965)
Research report and development of a new method - Na_2SO_3 reduces Cu(II) to Cu(I). This precipitates iodide and thiocyanate but not chloride.

*ANAL QUAL 2

Qualitative Analysis for Aluminum
Paul, A. D.; Gibson, J. A., Jr.
J. Chem. Educ. 39 ,398 (1962)
Refined procedure using morin avoids interferences which are otherwise a major problem. "Morin" is an organic pptng agent.

*ANAL ORG CONSUMERPROD GC NATPROD 3

The Fatty Acid Composition of Edible Oils and Fats: A Beginning GLC Experiment
Paulson, D. R.; Sarento, J. R.; Forman, W. A.
J. Chem. Educ. 51 ,406 (1974)
Samples of C(17) to C(20) aliphatic acids co-injected as the methyl esters (obtained by BF_3-catalyzed transesterification) with methyl heptadecanoate. Caution: BF_3 (toxic).

*ANAL ORG ASPIRIN PHARM TLC 3 HAZARD

TLC Detection of Caffeine in Commercial Products
Pavlik, J. W.
J. Chem. Educ. 50 ,134 (1973)
Silica gel TLC plates. 8 appropriate solvent systems. Anacin, APC, Bufferin, Excedrin, Nodoz, etc. Hazard: avoid the use of benzene and chloroform (carcinogens) even on a micro scale.

*ANAL ORG PREP UVIS 3

Two Nitrosophenol Reagents for Iron(II) and Cobalt.
Peach, S. M.
J. Chem. Educ. 42 ,437 (1965)
Dinitrosoresorcinol, sodium sulfonate and nitroso-4-chlororesorcinol are prepared and used in colorimetric analysis. Good combination of organic-analytical, simple preparation.

*ANAL UVIS 2

The Turbimetric Determination of Lead
Perkins, G., Jr.; Wimberley, J. W.; Lamb, J. F.; Maurer, L. E.
J. Chem. Educ. 38 ,358 (1961)
Spec-20 or Duboscq colorimeter. Rgnt: ammonium molybdate. Comparison standard: thymol blue. Caution: lead is an embryotoxin.

*ANAL COMPUTER GC INSTR 4

On-Line Digital Computer Applications in Gas Chromatography: An undergraduate analytical experiment
Perone, S. P.; Eggleston, J. F.
J. Chem. Educ. 48 ,438 (1971)
Exercise in interfacing a computer with a gas chromatograph. Program in BASIC given.

*ANAL INORG QUAL 1 HAZARD

A Spot Test for Cadmium
Petroccione, J. F.
J. Chem. Educ. 35 ,402 (1958)
Cd^{++} can be detected in the ammoniacal solution with Titan Yellow. Cu^{++} does not interfere. This test was developed for high school students. HAZARD: avoid cadmium.

*ANAL ORG PHYS KIN REDOX UVIS 4

Periodate Oxidation of Vicinal Hydroxyls. Applications to Student Experiments
Pilch, P. F., Somerville, R. L.
J. Chem. Educ. 54 ,449 (1977)
Periodate oxidations may be easily followed (Spec 20) in that unreacted periodate will rapidly bleach the violet compound ferrous 2,4,6-tri-2-pyridyl-s-triazine to a colorless compound. Second order plots of two such oxidations are given. Other experiments are suggested.

*ANAL COLUMNC GC TLC 3 HAZARD

Separation by Adsorption Chromatography: An experiment on a colorless mixture
Pine, S. H.
J. Chem. Educ. 43 ,672 (1966)
Dry-pack column, TLC or GC to separate 1-phenylethanol and acetophenone. HAZARD: chloroform (carcinogen), avoidable.

*ANAL ORG FORENSIC GC IR NMR PREP SEQ 4

A Benzidine Rearrangement and the Detection of Trace Quantities of Blood. A Laboratory Experiment in Criminalistics.
Pinkus, J. L.; Goldman, L. S.
J. Chem. Educ. 54 ,310 (1977)
3,5,3',5'-tetramethylbenzidine prepared from 2,6-dimethylaniline in 3-step synthesis used as a reagent for blood, avoids carcinogenic compounds. Caution: blood is an infection hazard.

*ANAL ASPIRIN IONX PHARM UVIS 3

Quantitative Analysis of APC Tablets: An Easy Experimental Method Based on the Use of Ion-Exchange Resins.
Pisani, G. F.
J. Chem. Educ. 53 ,733 (1976)
Anion exchange resin will retain acetylsalicylic acid much more strongly than phenacetin and caffeine. Fraction collector. UV-spectrophotometric analysis of eluate fractions.

*ANAL AA NATPROD 3 HAZARD

The Determination of Zinc in Hair Using Atomic Absorption Spectroscopy
Pomeroy, R. K.; Drikitis, N.; Koga, Y.
J. Chem. Educ. 52 ,544 (1975)
Detailed directions for sample preparation and atomic absorption spectroscopy. Hazard: org. sample (hair) decomposed in hot, conc. perchloric-nitric acid mixture. Explosion hazard.

*ANAL INORG PAPERC 2 HAZARD

Paper Chromatography and Spot Tests: A useful combination of techniques
Poonia, N. S.
J. Chem. Educ. 43 ,423 (1966)
Radial disk paper chromatography of anions and cations. HAZARD: chloroform in developing solvent is a carcinogen; replace.

*ANAL QUAL 3

Detection of Iron with Salicylimine
Poonia, N. S.; Bakre, V. P.; Bal, M. S.
J. Chem. Educ. 44 ,483 (1967)
Spot test - improved sensitivity for both Fe(II) and Fe(III).

*ANAL QUAL 3

Spot Tests for Silver (I) and Manganese (II)
Poonia, N. S.; Gupta, H. K. J.
J. Chem. Educ. 44 ,480 (1967)
Piperidine enhances formation of black or colored spot test from dilute manganese(II) and silver salt solutions.

*ANAL PAPERC QUAL 2

Piperidine-A Spot Reagent for Mn(II)
Poonia, N. S.; Gupta, H. K. L.
J. Chem. Educ. 42 ,438 (1965)
Spot tests on filter paper strips

*ANAL INORG QUAL 2

Separation and Identification of Copper and Cadmium
Poonia, N. S.; Gupta, H. K. L.
J. Chem. Educ. 41 ,439 (1964)
3 semi-micro procedures for the quantitative wet separation of Cu and Cd using organic precipitating reagents. Hazard: Cd (toxic)

*ANAL POLYMER APPARATUS COMPUTER IR NOPROC 4

Laboratory Automation in the Undergraduate Curriculum:
Determination of polyethylene chain branching by computerized IR methods
Powers, D. E.; Harris, W. C.; Kalasinsky, V. F.
J. Chem. Educ. 56 ,128 (1979)
Computer-interfaced IR for analysis

*ANAL ORG ACBA ASPIRIN ELECTROANAL PHARM 2

Analysis of Aspirin: a Conductometric Titration
Proctor, J. S.; Roberts, J. E.
J. Chem. Educ. 38 ,471 (1961)
Titn with std base assuming acetylsalicylic acid is total acid. Simple conductance bridge Children's aspirin, etc.

*ANAL INORG DEMO GRAVIM 3

Precipitation of Lead Chromate from Homogeneous Solution: A Lecture Demonstration or a Laboratory Experiment
Ramette, R. W.
J. Chem. Educ. 49 ,270 (1972)
Chromate is generated by oxidation of Cr(III) with bromate. Demo shows slow pptn. yields filterable crystals, in contrast to simple mixing of reactants.

*ANAL EDTA 4 HAZARD

EDTA Titration of Cadmium and Mercury: An Exercise in Logic.
Ramsay, C. G.
J. Chem. Educ. 54 ,714 (1977)
Cd^{++} and Hg^{++} can be determined by reacting with an excess of EDTA and back-titrating with Zn^{++}. Experiment investigates use of masking reagents to permit individual determination of these species. Optimum conditions for masking are determined.
HAZARD: Cd^{++} and Hg^{++} solutions are toxic.

*ANAL EDTA REVIEW TECHNIQUE TITN 3

Chelon Approach to Analysis: II. Illustrative experiments
Reilley, C.; Schmid, R. W.; Sadek, F.
J. Chem. Educ. 36 ,619 (1959)
14 experiments are described (in varying amounts of detail) for the determination of various metal ions by EDTA titration. Masking techniques are described, and various methods of separation are employed before titration. Details of solution preparation are given. There is sufficient detail for an upperlevel undergraduate to perform the experiments, but not for a freshman.

*ANAL NOPROC QUAL 2

New Confirmatory Tests for Manganese, Antimony, Lead, Mercury, and Chromium
Rich, R.
J. Chem. Educ. 39 ,400 (1962)
Improvements or improved alternatives suggested.

*ANAL QUAL 2

The Cyanocobaltate Scheme of Qualitative Analysis
Rich, R.
J. Chem. Educ. 39 ,403 (1962)
Novel scheme for Na, K, Mg, Ca, Sr, Ba, Ti, Cr, U, Mn, Fe, Co, Ni, Cu, Ag, Zn, Cd, Hg, Al, Sn, Pb, Sb, Bi.

*ANAL IONX QUAL SOLUB 2

Dissolving Difficultly Soluble Salts with Chelating Ion Exchange Resins
Rich, R.
J. Chem. Educ. 40, 414 (1963)
Research report. Mix finely ground salt with resin (aq) and allow to stand. Dissolving times (remarkably short) given for 12 common insol. salts, e.g., $BaSO_4$.

*ANAL INORG QUAL 1 HAZARD

A Laboratory Exercise Emphasizing Deductive Chemical Reasoning
Ricketts, J. A.
J. Chem. Educ. 37, 311 (1960)
Qual. techniques and logic exemplified with a simplified set of cations, viz. silver(I), mercury(I), cadmium, aluminum, and barium. HAZARD: avoid cadmium

*ANAL ACBA ELECTROCHEM ELECTRODE NOPROC PH 2

Acid-Base Titrations with the Tellurium Electrode
Ricketts, J. A.; Bowen, R. E.
J. Chem. Educ. 37, 473 (1960)
An experiment is described where the student simultaneously titrates an acid with a base using 1) a tellurium-tellurium oxide electrode and 2) an ordinary glass electrode.

*ANAL ORG DEMO NATPROD TLC 1 2 HAZARD

Thin Layer Chromatographic Separation of Leaf Pigments: A rapid demonstration
Rollins, C.
J. Chem. Educ. 40, 32 (1963)
Quick, straightforward. See Anwar, M.H., J. Chem. Educ. 40, 29(1963). HAZARD: benzene (carcinogen), avoidable.

*ANAL ORG IONX ISOMERS UVIS 5

Separation of Bromoaniline Isomers by Cation-Exchange Chromatography.
Romano, S. J.
J. Chem. Educ. 47, 478 (1970)
Sephadex C-25 CM, macro and micro columns, 10-mm flow cell. Packing details but little other procedure given.

*ANAL ORG ASPIRIN FORENSIC PHARM TLC 3

An Organic Chemistry Experiment for Forensic Science Majors
Rothchild, R.
J. Chem. Educ. 56, 757 (1979)
Extraction of components of over-the-counter analgesics and their safe TLC analysis with non-carcinogenic solvents. Suggested procedure only.

*ANAL INORG QUAL 2 HAZARD

Separating Copper from Cadmium Without Cyanide
Sanyal, S.
J. Chem. Educ. 36, 387 (1959)
Short note. Sep'n is by extraction of Cd^{++} from mixed sulfide ppt. with dilute H_2SO_4. HAZARD: avoid cadmium.

*ANAL COLORIM ENVIRON TITN WATERCHEM 2

A Study of Water Pollution - An undergraduate laboratory experience.
Sarkis, V. D.
J. Chem. Educ. 51, 745 (1974)
Hach (direct reading) colorimetric unit used for inorganic constitutents. Based on American Public Health methods.

*ANAL ORG TITN 4

Periodate Cleavage of Glycols: A quantitative organic analysis experiment
Schenk, G. H.
J. Chem. Educ. 39, 32 (1962)
Periodic acid is standardized with sodium arsenite - iodine. Extension: study pH profile (time of reaction).

*ANAL COLUMNC COORD UVIS 3

Column Chromatography and Spectrophotometry for Separating Two Cobalt Complexes
Schmitt, D. L.; Jonassen, H. B.
J. Chem. Educ. 46, 47 (1969)
Small silica gel column. Elution with water separates $(Co(NH_3)_5Cl)Cl_2$ and $(Co(NH_3)_6)Cl_3$, but not very well. Analysis by visible spect. Refers earlier article on prepn. and spectroscopy.

*ANAL APPARATUS DEMO PH TITN 2

Comparison of Strong Acid and Weak Acid Titration Curves.
Schultz, G. W.; Spannuth, S. L.
J. Chem. Educ. 56, 194 (1979)
Apparatus for plotting acid/base titration curves using readily available lab equipment described.

*ANAL COORD ELECTROANAL KEQ STOICH 4

Stoichiometry and Formation Constant Determination
Schultz, F. A.
J. Chem. Educ. 56, 62 (1979)
Pb(II)-oxalate forms two complexes, one soluble. Analysis of polarographic results is not simple.

*ANAL ELECTROCHEM ELECTRODE TITN 4

A Student Constructed Potentiometric Electrode and Semi-auto Titrator System
Seemuth, D. P.; Hall, J. L.; Robertson, K. A.; Huber, C. O.
J. Chem. Educ. 56, 65 (1979)
Details of construction of lead-dioxide electrode given and its use in acid-base titration described.

*ANAL INSTR TITN UVIS 3 4

Analysis of Tartar Emetic: A photometric titration
Sellers, D. E.; Tang, S. S. N.; VanAtta, R. E.
J. Chem. Educ. 39, 408 (1962)
KMnO4 titration with spectroscopic (colorimetric) endpoint. Semimicro buret, stirred cell or manual stirring. Anal. of results of 23 expts.

*ANAL NATPROD PROJ REDOX 2 HAZARD

The Determination of Iodide in Seaweed: A General Chemistry Research Experience
Senyk, J. I.
J. Chem. Educ. 54, 511 (1977)
A project to determine the best method of solution and titrimetric determination of iodine in sea weed. All methods involve the oxidation of iodide to iodine, extraction into chloroform (HAZARD: carcinogen; substitute dichloromethane) and subsequent titration with thiosulfate. For very small classes.

*ANAL DRYLAB INSTR PROJ 4

Project Select: An assignment in instrument evaluation for undergraduate analytical students
Settle, F. A.
J. Chem. Educ. 56, 411 (1979)
Hypothetical analytical situation as in a commercial analytical lab plus manufacturers' literature. Select instrument. Sample questions given.

*ANAL ORG ASPIRIN PH TITN 2

Potentiometric Titration of Aspirin in Ethanol
Shen, S. Y.; Gilman, A. J.
J. Chem. Educ. 42, 540 (1965)
pH meter, titrant: alcoholic KOH. Non-aqueous pot. tit'n with glass electrode.

*ANAL COORD DEMO IONX PAPERC PROJ 2

Ion-Exchange Papers
Sherma, J. A.
J. Chem. Educ. 39, A83 (1962)
Separation of iron(III) nitrate and cobalt(II) chloride on ion exchange paper. Others suggested.

*ANAL ACBA GRAVIM IONX STOICH TITN 2

The Stoichiometry of Hydrated Copper Sulfate: A general chemistry laboratory experiment
Silber, H. B.
J. Chem. Educ. 49, 586 (1972)
Cu^{++} by tit'n of H^+ released from ion-exchanger. $SO4(=)$ as BaSO4. Water by difference. BaSO4 weighed on dried filter paper.

*ANAL ACBA GRAVIM IONX PROJ STOICH TITN 4

The Analysis of an Unknown Lanthanide Salt: A set of analytical experiments
Silber, H. B.
J. Chem. Educ. 50, 720 (1973)
La^{+++} by tit'n of H^+ released from ion-exchanger. La^{+++} also gravimetric by oxalate and volumetric as oxalate-permanganate titn. Student is issued an unknown La(III) salt for total analysis. About 4 lab periods.

*ANAL ORG TLC 3

Determining the Molecular Weight of Normal Fatty Acids by Thin Layer Chromotography
Singh, E. J., Zuspan, F. P.
J. Chem. Educ. 50 ,625 (1973)
Silica gel Rf values of straight-chain carboxylic acids are a linear function of molecular weight. Visualization by spraying with dilute chromic acid. Moving phase is water sat'd butanol. Caution: avoid inhaling chromic acid dust (causes severe lung damage).

*ANAL PAPERC QUAL 2

The Paper Chromatographic Separation of the Ions of Elements 26 Through 30: A laboratory experiment
Skovlin, D. O.
J. Chem. Educ. 48 ,274 (1971)
Elements spotted as chlorides. Moving phase 2-butanone. Visualization by spot reagents. Within capacity of many high school students.

*ANAL INORG COORD ELECTROANAL STOICH TITN UVIS 2

Composition of Metal Ammine Ions
Slabaugh, W. H.
J. Chem. Educ. 42 ,470 (1965)
Short note. potentiometric titration (Ag^+), photometric titration (Cu^{++}). Metal ions are titrated with aq. NH_3. Caution: do not store Ag^+-NH_3 solns.

*ANAL APPARATUS ELECTROANAL 4

A Comprehensive Experiment in Electroanalytical Chemistry
Smith, D. M.
J. Chem. Educ. 49 ,87 (1972)
A modular electrochem unit incorporates a polarograph, potentiometer, pH meter, chronopotentiometer, constant voltage supply, etc. One example procedure in detail: coulometric titration of As(III) with I^-.

*ANAL ENVIRON REDOX TITN WATERCHEM 2 HAZARD

Dissolved Oxygen: A Relevant Experiment for the Introductory Laboratory
Stagg, W. R.
J. Chem. Educ. 49 ,427 (1972)
O_2 from air absorbed in alkaline Mn(II); iodometric titration. HAZARD: sodium azide, used to scavenge nitrite, is toxic and a storage hazard.

*ANAL ACBA REDOX STOICH TITN 2

Writing a Chemical Equation from Titration Data: Experiment for general chemistry
State, H. M.
J. Chem. Educ. 39 ,297 (1962)
Analyzed solutions of NaOH and H_3PO_4 titrated to two different indicators to allow students to find stoichiometric factors. Similarly, previously analyzed solution of aq. I_2 titrated w. std thiosulfate to starch endpoint. Minimal directions.

*ANAL ORG TITN 3

Molecular Weight Determination of Aldehydes and Ketones: A Quantitative Organic Experiment
Steinhaus, R. K.
J. Chem. Educ. 50 ,293 (1973)
Acid hydrolysis of semicarbazone gives semicarbazide. This can be titrated with N-bromosuccinimide. Complete procedure given.

*ANAL AA ENVIRON 2

An Atomic Absorption Experiment for Environmental Chemistry
Stemporzewski, S. E.; Butler, R. A.; Barry, E. P.
J. Chem. Educ. 51 ,322 (1974)
Lead and zinc in street debris. Straightforward, full directions.

*ANAL APPARATUS CHROMATOG ENVIRON GC INSTR 4

Analysis of an Important Air Pollutant: Peroxyacetyl Nitrate
Stephens, E. R.; Price, M. A.
J. Chem. Educ. 50 ,351 (1973)
Electron-capture chromatography. Modified Perkin-Elmer 137B IR spectrophotometer, UV source, electron-capture detector (incorporates a beta beta generator).

*ANAL INORG QUAL SOLUB 3

Separation of Arsenic and Copper in Qualitative Analysis
Stock, J. T.
J. Chem. Educ. 35 ,402 (1958)
Short note on the solubility of copper sulfide precipitate in ammonium polysulfide reagent when arsenic is present.

*ANAL IONSELECT 4

The Response of a Sodium-Ion Selective Electrode in Acid and Alkaline Media
Stock, J. T.
J. Chem. Educ. 47 ,593 (1970)
Explicit procedure using sodium-ion selective electrode. Hydrogen ion activity calculations.

*ANAL INORG QUAL 3

The Colorimetric Detection of Arsenic as Copper Arsenide
Stock, J. T.; Garcia, L. M.
J. Chem. Educ. 35 ,401 (1958)
An improvement on the arsine test. Copper arsenide forms as a dark stain when arsine comes into contact with paper wet with a copper solution.

*ANAL ORG PAPERC 3 HAZARD

Diazonium Salts as Spot Test and Synthetic Reagents
Stone, D. B
J. Chem. Educ 48 ,413 (1971)
Paper chromatography of various phenols. Visualization by diazotized p-nitroaniline. HAZARD: CHCl3 (carcinogen) used in developing - use a substitute.

*ANAL ORG COLUMNC NATPROD PAPERC SEPARATION TLC 2 3

Modifications of Solution Chromatography Illustrated With Chloroplast Pigments
Strain, H. H.; Sherma, J.
J. Chem. Educ. 46 ,476 (1969)
The definitive description of the refined techniques needed for good results in extraction and chromatography of plant pigments.

*ANAL CHROMATOG COLUMNC HISTORIC 2 3

M. Twsett: "Absorption Analysis and Chromatographic Methods: Application to the Chemistry of the Chlorophylls"
Strain, H. H., Sherma, J.
J. Chem. Educ 44 ,238 (1967)
Historic experiment. CaCO3 column, green leaves.

*ANAL QUAL TECHNIQUE 2

Improving the Potassium Flame Test
Strong, F. C., III
J. Chem. Educ. 46 ,178 (1969)
Simple modifications.

*ANAL COLUMNC CONSUMERPROD DISTRIB GC PESTICIDE TLC 4

An analytical procedure for the determination of pesticides in food.
Subach, D. J.; Bell, M. E. B.
J. Chem. Educ. 50 ,855 (1973)
Analysis for Chlordane, Endrin, Heptachlor, etc. in vegetable produce. 3-4 lab periods. Florisil column. CAUTION: pesticides - extr. toxic.

*ANAL ENVIRON NOPROC 2

Air Pollution Measurements in the Freshman Laboratory
Suplinkas, R. J.
J. Chem. Educ. 49 ,24 (1972)
To accompany a non-majors "chemistry and environment" course. Commercial portable gas train.

*ANAL ORG TLC 3 HAZARD

A Spray Technique for the Preparation of TLC Plates
Swaim, P. D.; Loyola, V. M.; Harlan, H. D.; Carlo, M. J.
J. Chem. Educ. 51 ,331 (1974)
Silica gel slurry sprayed on with Sears-Roebuck paint sprayer. Rf values given for caffeine, etc. HAZARD: benzene (carcinogen), is avoidable.

*ANAL ELECTROCHEM KSP 2 3

Potentiometric Determination of Solubility Product Constants: A laboratory experiment
Tackett, S. L.
J. Chem. Educ. 46 ,857 (1969)
Silver and calomel electrodes and standard Ag^+, Br^-, I^-, and Cl^- solutions required. Modification used at Stony Brook; works well.

*ANAL ELECTROANAL NOPROC STATISTICS TITN 4

Comparison of Endpoint Methods: A coulometric titration experiment.
Tackett, S. L.
J. Chem. Educ. 49 ,52 (1972)
Oxidation of arsenite by electrolytically generated iodine, comparing three endpoint methods: (1) starch, (2) potentiometric, (3) amperometric. Statistics used in calibration of 1-ml pipets.

*ANAL APPARATUS HANDICAPPED PH TITN 2

A pH Titration Apparatus for the Blind Student
Tallman, D. E.
J. Chem. Educ. 55 ,605 (1978)
Construction of the apparatus given

*ANAL AA APPARATUS 5 HAZARD

Determination of Mercury by a Simple Atomic Absorption Method
Thistlethwaite, P. J.; Trease, M.
J. Chem. Educ. 51 ,687 (1974)
Use of "ultraviolet shadow" of mercury to analyze for trace Hg in aq. sol'ns. Apparatus design shown. Has not been used as a lab exercise. See also Arganer,P.J.; White,C.E., J. Chem. Educ. 49, 27(1972). Hazard: mercury vapor.

*ANAL ORG IONX PAPERC 3 HAZARD

Ion Exchange Paper Chromatography
Thomas, A. T.; Phillips, J. P.
J. Chem. Educ. 38 ,406 (1961)
Arginine, tyrosine, leucine and aspartic acid separated on a cation-exchange impregnated paper, and on Whatman #4 filter paper. A ninhydrin dip was used for visualization. HAZARD: ninhydrin is a carcinogen.

*ANAL PREP UVIS 4

The Preparation of Barium Chloranilate
Thomas, E. B.
J. Chem. Educ. 36 ,383 (1959)
Preparation of a reagent for the colorimetric det'n of sulfate from chloroanilic acid and barium hydroxide. Straightforward.

*ANAL ORG ACBA TITN 4

Determination of Saponification Equivalents of Phenolic Esters
Tobey, S. W.; McGregor, S. D.; Cottrill, S. L.
J. Chem. Educ. 38 ,611 (1961)
Modification of an old procedure gives good results with phenolic esters.

*ANAL APPARATUS FORENSIC NOP' OC REDOX 2

Determination of Alcohol in Breath for Law Enforcement
Treptow, R. S.
J. Chem. Educ. 51 ,651 (1974)
Dichromate-photometric breath analyzer.

*ANAL AA ENVIRON 2

Roadside Salt Pollution and the Absorption Emission Spectra of Sodium. a General Chemistry Experiment
Tripp, T. B.; Nadeau, J. L.
J. Chem. Educ. 51 ,130 (1974)
Analysis of soil samples and rock salt.

*ANAL ORG APPARATUS GC INSTR 3

An Undergraduate Experiment in Gas Chromatography and C,H-Microanalysis
Tse, R. S.
J. Chem. Educ. 48 ,550 (1971)
Construction of apparatus for carbon (as CO2) and hydrogen (as H2O) in samples by combustion in a copper-copper oxide packed tube furnace followed by gc (thermal conductivity).

*ANAL ORG QUAL 3 HAZARD

A Test for the Subclasses of Aliphatic Amines
Valentine, J. L.; Entriken, J. B.; Hanson, M. W.
J. Chem. Educ. 41 ,569 (1964)
Describes use of 3,3',5,5'-tetrabromophenolphthalein ethyl ester (bromphthalein magenta E) as a qualitative reagent. HAZARD: CCl4

*ANAL ORG CONSUMERPROD DISTRIB UVIS 3

Ultraviolet Spectrophotometric Determination of Caffeine in Cola Drinks.
VanAtta, R. E.
J. Chem. Educ. 56 ,666 (1979)
Caffeine is extracted from cola with dichloromethane. Standard caffeine solution needed. Within capacity of most second-semester freshman.

*ANAL ACBA APPARATUS ELECTROCHEM INSTR 4

Precise Coulometric Titrations Based on Silver Coulometer Measurements
VanLente, K. A.; VanAtta, R. E.; Willard, H. H.
J. Chem. Educ. 36 ,576 (1959)
Research report. A new type of silver coulometer and a simpler apparatus suitable for a laboratory experiment is described. No procedure.

*ANAL QUAL 2

A Spot Test Scheme for the Identification of Metal Ions
Vavoulis, A.
J. Chem. Educ. 39 ,395 (1962)
Spot tests (no new ones) incorporated into a qual. scheme.

*ANAL INORG IONX QUAL 2 HAZARD

Ion Exchange Separation of Cadmium
Vick, M. M.; Harris, L. H.
J. Chem. Educ. 38 ,414 (1961)
An in situ ion exchange method which may be applicable to other species. Dowex-1 HAZARD Cd** is a serious liver-kidney poison.

*ANAL INORG QUAL 2 HAZARD

A Non-Cyanide Separation of Copper from Cadmium
Waggoner, W. H.
J. Chem. Educ. 37 ,411 (1960)
Thiocyanate ion will precipitate Cd** from acid solution, but will not ppt Cu** HAZARD. avoid Cd**.

*ANAL INORG ORG PAPERC QUAL 2

Experiments in Inorganic Paper Chromatography
Walton, H. F.
J. Chem. Educ. 42 ,477 (1965)
Sensitive spot tests allow det'n of uranium, copper, cobalt, nickel. Easy.

*ANAL INORG QUAL 3

The Inclusion of Tungsten and Thallium in the Elementary Scheme of Qualitative Analysis
Waters, K. L., Brockman, C. J.; Waggoner, W. H.
J. Chem. Educ. 34 ,137 (1957)
Explicit. Intended to enrich a classical qual. course. Tl(I) and W(VI) ppt with the Group I cations. Tl(I) follows Pb(II) through the classical scheme; W(VI) follows Ag(I). Tl(I) is separated as the chromate and d'td as the iodide. W(IV) is separated as the heteropoly phosphate and d'td as tungstic acid Basic Brown complex.

*ANAL QUAL 2

The Identification of an Unknown Alloy: A first experiment in elementary chemistry
Watson, N. V.
J. Chem. Educ. 48 ,324 (1971)
Note reports successful use of a "guided tour" experiment to analyze Mg-Al alloys using physical properties, acid solubility, and a limited number of reagents as a first experiment.

*ANAL COMPLEXIM CONSUMERPROD EDTA 2

A Simple Titrimetric Determination of Lead in Gasoline
Watt, S. L.; Martino, T. M.; Chamberlain, M. A.; Laswick, P. H.
J. Chem. Educ. 54 ,262 (1977)
One period, straightforward.

*ANAL INSTR UVIS 3

Dependence of the Beer-Lambert Absorption Law on Monochromatic Radiation: An experiment in spectrophotometry
Wentworth, W. E.
J. Chem. Educ. 43 ,262 (1966)
Pr(+3) spectrum 420-620 nm has 4 absorptions of various 1/2 band widths. Absorption measurements (Beckman DU) depend on whether a wide peak or a sharp peak is measured.

*ANAL APPARATUS ENVIRON QUAL TECHNIQUE 2 3

Air Pollution Studies: The ring oven technique
West, P. W.; Sachdev, S. L.
J. Chem. Educ. 46 ,96 (1969)
Easily prepared apparatus used to obtain and analyze particulates.

*ANAL INORG QUAL REVIEW 3

Qualitative Analysis and Analytical Chemical Separations Without the Use of Sulfides
West, P. W.; Vick, M. M.
J. Chem. Educ. 34 ,393 (1957)
Complete flow-charts, minimal procedures. Non-sulfide separations are discussed. Groups are 1) chloride group, 2) basic benzoate, 3) fluoride, 4) hydroxide. 18 references.

*ANAL INORG PREP TITN 4 HAZARD

Total Analysis of Tin Tetraiodide: A multipurpose experiment
Wheatland, D. A.
J. Chem. Educ. 50 ,854 (1973)
Prepn. by direct combination of elements (ref.). Comparison of four titrimetric methods for chloride and four for tin. No procedure for titrations. HAZARD: chloroform, carcinogen

*ANAL ACBA ELECTROANAL 3

Tris(hydroxymethyl)aminomethane as a Titrimetric Standard
Whitehead, T. H.
J. Chem. Educ. 36 ,297 (1959)
Reagent named in title is now available in pure form (Certified Reagent T-395). Potentiometric titration shows this reagent has only one stoichiometric point at pH 4.5.

*ANAL QUAL 2 HAZARD

The Separation and Identification of Cadmium and Copper Ions
Whitehead, T. H., Hatcher, G. K.
J. Chem. Educ. 39 ,399 (1962)
A shorter procedure, avoiding cyanide, is the differential reduction Cu(II) to Cu(I), and precipitation as cuprous acetylide. This is reported to be shock sensitive when dry, but authors of article find the precipitate is stable. Avoid cadmium, acetylides.

*ANAL INORG ORG PHYS INTEGR NOPROC RADIOCHEM 2

A New Freshman Chemistry Laboratory Program
Wiberley, S. E., Richtol, H. H.
J. Chem. Educ. 41 ,146 (1964)
Description of lab program, heavily oriented towards instrumentation. Includes gc, ir, prep, sol'n equilib., phase equilib., etc.

*ANAL INSTR PHOTO TECHNIQUE 3

An Experiment in Flame Photometry
Willard, H. H.; Lente, K. A.; VanAtta, R. E.
J. Chem. Educ. 34 ,192 (1957)
Beckman B with flame attachment. Representative unknowns. Trace analysis: Na(I), K(I), Ba(II), etc. Wave-lengths of measurement given.

*ANAL INORG QUAL 3 HAZARD

A Specific Qualitative Reagent for Copper
Williams, T. R.; Burton, F.
J. Chem. Educ. 38 ,413 (1961)
T-sulfonamididine precipitates copper quantitatively over a wide pH range. Cd^{++} does not interfere. HAZARD: procedure was devised before Cd^{++}, thioacetamide were known to be dangerous.

*ANAL MICELLE QUAL 2

The Use of Polyelectrolytes to Improve Qualitative Analysis Preparations
Williams, T. R.; Carter, R.
J. Chem. Educ. 41 ,442 (1964)
Modification of conventional qual. procedures incorporates flocculating agents - makes separations cleaner, easier.

*ANAL INORG APPARATUS QUAL 2

A Gas Testing Device Using Liquids or Test Papers
Williams, T. R.; Stock, J. T.
J. Chem. Educ. 36 ,384 (1959)
Diagram is given for an inexpensive "gas testing device" for qual. analysis.

*ANAL NOPROC REDOX STOICH TITN UVIS 2

A New Oxidation-Reduction Experiment
Williams, T. R.; Vandoren, J. D.
J. Chem. Educ. 51 ,421 (1974)
Reduction of Ce(IV) by iodide. Calibration curve prepared and absorbance at 375 nm used to measure Ce(IV) before and after addition of measured aliquot of std. reductant. Stoichiometry of redox reaction then determined.

*ANAL PHYS IR TECHNIQUE 4

Integrated Infrared Band Intensities: A physical chemistry experiment
Wilson, H. W.
J. Chem. Educ. 51 ,392 (1974)
$CHCl_3$ at 1216 cm^{-1}. Comparision of different mathematical methods for estimating area under the band.

*ANAL CHROMATOG CONSUMERPROD DEMO NATPROD 1 HAZARD

Chromatography on Chalk
Wollrab, A.
J. Chem. Educ. 52 ,809 (1975)
Easy demo using felt-tip markers, inks, extracts of flower petals, etc., and ordinary chalk. HAZARD (avoidable): benzene, carbon tet.

*ANAL GRAVIM SEMIQUANT STOICH 2 HAZARD

Determination of the Equivalent Weight of Metals: A freshman research project
Wolthuis, E., DeVries, D., Poutsma, M.
J. Chem. Educ. 34, 133 (1957)
A weighed amount of Zn, Cd or Mn metal is dissolved in a weighed Erlenmeyer flask containing 6M HCl and the resulting solution evaporated to dryness. The flask + residue (assumed to be the anhydrous chloride) is then weighed. Analysis of sources of error is given; student analyses show an average error of approx. 0.25%. HAZARD: avoid cadmium.

*ANAL ACBA COMPUTER KEQ TITN 2

Automatic Titrimetry in Introductory College Chemistry
Zajicek, O. T.
J. Chem. Educ. 41, 554 (1964)
Titr. of unknown mixture of a strong and a weak acid. Optional data reduction by computer. Requires a constant rate buret and a recording pH meter.

*BIOCHEM ENZYME NATPROD PAPERC 2 HAZARD

Demonstration of Transketolase Activity in Plant Leaves. Synthesis of L-Glucoheptulose.
Abernethy, J. L.
J. Chem. Educ. 42, 286 (1965)
Mature plant leaves take L-arabinose from solution and enzymatically form L-glucoheptulose. Identified by paper chromatography. Color developed by orcinol in trichloroacetic acid. HAZARD: trichloroacetic acid gives serious skin burns.

*BIOCHEM ORG CHIRAL ENZYME 3 HAZARD

Papain as an Enzyme Catalyst in Undergraduate Organic Chemistry
Abernethy, J. L.; Kientz, M.
J. Chem. Educ. 36, 582 (1959)
Synthesis with aromatic amines or hydrazides and amino acids (hippuric, carbobenzoxy-D,L-alanine). Enzyme activated with H2S. Stored under refrigeration for long life. May include resolution of D,L-alanine, synthesis of substrates. Crude incubator. HAZARD: H2S - nerve toxin.

*BIOCHEM NUCL.ACID POLARIM 3

Optical Rotation and the DNA Helix-to-Coil Transition: An undergraduate project
Baker, G. L.; Alden, M. E.
J. Chem. Educ. 51, 591 (1974)
Optical rotation of DNA (purchased) solution measured with (filtered) yellow-green light at 30-100 deg. in apparatus constructed in labs.

*BIOCHEM PHYS ELECTROPHOR KIN VITAMIN 3

Paper Electrophoretic Study of Rates of Consecutive Reactions: The Deamidation of Vitamin B-12
Barlow, G. H.
J. Chem. Educ. 38, 37 (1961)
Hydrolysis with hydrochloric acid. Samples taken at various times and examined by paper electrophoresis.

*BIOCHEM INORG KIN PORPHYRINS PREP PROJ 4 5

An Advanced Laboratory Experiment in Bioorganic Chemistry
Beckmann, B. A.; Buchman, A.; Pasternack, R. F.; Reinprecht, J. T.
J. Chem. Educ. 53, 387 (1976)
Preparation of m- and p-phenyl substituted derivatives of alpha, beta, gamma and delta-tetraphenylporphine from pyrrole (lit. ref. given) zinc derivatives and UV. Data for 12 compounds given. Kinetics of metal ion insertion into tetrakis(4-N-methylpyridyl)porphine (prepared from tetrakis(4-pyridyl)porphine (synthesized or purchased).

*BIOCHEM PHYS ENZYME KIN UVIS 4

Alpha-Chymotrypsin: Enzyme concentration and kinetics
Bender, M. L.; Kezdy, F. J.; Wedler, F. C.
J. Chem. Educ. 44 ,84 (1967)
Hydrolysis of 4-nitrophenyl trimethylacetate catalyzed by alpha-chymotrypsin in thermostatted cell followed by visible spectroscopy.

*BIOCHEM PHYS PH VISC 3

Viscometric Determination of the Isoelectric Point of a Protein
Benson, J. E.
J. Chem. Educ. 40 ,468 (1963)
Viscosity of gelatin solutions measured (Ostwald viscometer) as a function of pH.

*BIOCHEM PHYS KIN MEMBRANE UVIS 3 4

Kinetics of Solute Permeability in Phospholipid Vesicles
Bittman, R.; Blau, L.
J. Chem. Educ. 53 ,259 (1976)
Liposomes prepared (not by students?) from phosphatidylcholines, some with added cholesterol. Assay of non-electrolyte (eg glycol, thiourea) permeability and of water permeability by absorbance at 600 nm. Can be combined with series of expts. on egg-yolk lipids published earlier.

*BIOCHEM ENZYME 2 3

A Laboratory Demonstration of Blood Catalase
Blackwell, R. Q.; Fosdick, L. S.
J. Chem. Educ. 32 ,588 (1955)
Catalase in blood measured by temperature rise in the decomposition of a standard hydrogen peroxide solution. Simple apparatus.

*BIOCHEM IONX PAPERC RADIOCHEM SVEX TRACER UVIS 4

The Incorporation of Glucose into Chelidonic Acid: An experiment in plant biochemistry
Bohm, B. A.
J. Chem. Educ. 43 ,539 (1966)
Incorporation of a precursor into a naturally-occuring molecule. C-14 labelled glucose is fed to a lily-of-the-valley plants. After metabolism, plant tissue is extracted with boiling ethanol. Presence of chelidonic acid (I) establ. by paper chromatog.; site of C-14 atoms in (I) est. by cleavage of (I) with aq. Br2. Much manipulation.

*BIOCHEM ANAL PAPERC 4

Descending Paper Chromatography of Oligosaccharides: A Biochemistry Laboratory Experiment
Borders, C. L., Jr.
J. Chem. Educ. 49 ,437 (1972)
Commercial chamber. Moving phase: ethyl acetate-pyridine-water. Visualization by alkaline silver oxide spray. Rg (glucose) values for 12 di- and tri-saccharides.

*BIOCHEM TECHNIQUE UVIS 4

A Sedimentation Experiment Using a Preparative Ultracentrifuge
Boudreau, R. E.; Heaney, A.; Weller, D. L.
J. Chem. Educ. 52 ,128 (1975)
Devised for molecular biology course. Illustrates use of ultracentrifuge in isolating and purifying bacterial ribosomes, determining sedimentation coefficients and subunit structure of 70-S ribosome, and role of magnesium ion in associating of subunits.

*BIOCHEM ANAL ENZYME KIN UVIS 3

A Spectrometric Assay of Polyphenoloxidase Activity: A Special Project in Enzyme Characterization.
Boyer, R. F.
J. Chem. Educ. 54 ,585 (1977)
Polyphenoloxidase (tyrosinase) is extracted from food (potatoes) with a phosphate buffer. Kinetics of hydroxylation of dihydroxyphenylalanine measured by recording spectrophotometer at 475 nm (or spec 20). Inhibition studies are suggested.

*BIOCHEM AFFC UVIS 4 HAZARD

The Separation of Chymotrypsin and Chymotrypsinogen:
An Affinity Chromatography Experiment for Biological Chemistry Students
Branchini, B.; Ziolkowski, R.
J. Chem. Educ. 56 ,281 (1979)
D-Tryptophan methyl ester was bound to CH-Sepharose 4-B by use of EDC, (1-ethyl-3-dimethylaminopropyl)carbodiimide, (HAZARD), using wrist shaker. Chymotrypsin and chymotrypsinogen separated by this column were assayed by hydrolysis of glutaryl-L-phenylalanine para-nitroanilide.

*BIOCHEM TLC 3 HAZARD

Peptide Hydrolysis and Amino Acid Hydrolysis: A first year organic or biochemistry experiment
Buchanan, D. N.; Kleinman, R. W.
J. Chem. Educ. 53 ,255 (1976)
HCl hydrolysis of glycyl-L-leucyl-L-tyrosine in sealed tube at 110 deg., developed in two different solvents. HAZARD: sealed tubes; internal pressure.

*BIOCHEM ENZYME KIN UVIS 4

Biochemistry: Cholinesterase Kinetics
Carper, M. A.; Carper, R. W.
J. Chem. Educ. 50 ,599 (1973)
Butyrylthiocholine iodide and acetylthiocholine iodide as substrates for horse serum butyryl cholinesterase. Kinetics measured by thiocholine color reaction with 5,5-dithio-bis-alpha-nitrobenzoate at 412 nm. Lineweaver-Burke plots interpreted to give pK's for Es complex, free enzyme, free substrate.

*BIOCHEM COMPLEX ENZYME FLUOR POLARIM 5

Biochemistry Laboratory Experiment: Polarized Fluorescence
Carper, M. A.; Carper, W. R.
J. Chem. Educ. 45 ,662 (1968)
Detection of ternary complexes of enzyme (bovine glucose dehydrogenase), dpn, and glucose and of inhibitor (pyridoxamine) by change in fluorescence (spectrofluorometer) and polarization (attached prisms).

*BIOCHEM ORG DISTRIB NATPROD PREP SEPARATION TLC 4

Pigments From Some Marine Specimens: The isolation and spectral characterization of spinochromes
Chang, C. W. J.; Moore, J. C.
J. Chem. Educ. 48 ,408 (1971)
Colored pigments in spines of sea urchins (gathered or purchased) isolated by acid dissolution and extraction of lipids. Separation on silica gel with plates deactivated by HCl.

*BIOCHEM ORG BACTERIA DEMO NATPROD 3

The Chemistry of Winemaking: An unique lecture demonstration
Church, L. B.
J. Chem. Educ. 49 ,174 (1972)
A year-long demo starting from grapes. Could be individual or group experiment. Wine chemistry illustrates many complex reactions. Complete procedure including when to file Form 1541 with the IRS.

*BIOCHEM ANAL PAPERC 3 HAZARD

Identification of Amino Acids in a Protein Hydrolysate by Paper Chromatography
Clapp, L. B.; Hansch, C.
J. Chem. Educ. 37 ,293 (1960)
Amino acid standards. Ninhydrin. Rf values for 16 amino acids.
HAZARDS: Sulfuric acid and barium hydroxide reaction is exothermic and not identified as hazardous in article. Ninhydrin is a suspected carcinogen.

*BIOCHEM ORG CHIRAL ENZYME PREP RESOLUTION 4

Enzymatic Resolution: An organic-biochemical laboratory experiment
Clement, G. E.; Potter, R.
J. Chem. Educ. 48 ,695 (1971)
Alpha-chymotrypsin used to resolve DL-phenylalanine. Detailed experimental directions. Useful for isolation of D-amino acids.

*BIOCHEM ANAL APPARATUS GC NATPROD 4

Gas Chromatographic Determination of Glutethimide in Biological Fluids: An Analytical Chemistry Experiment
Cohen, J. L.; Koda, R. T.
J. Chem. Educ. 51 ,133 (1974)
GC with flame ionization detector, glass column, centrifuge; aliquot mixer; p-dimethylaminobenzaldehyde; blood; urine. Glutethimide is a sedative-hypnotic drug. CAUTION: Blood is an infection hazard.

*BIOCHEM PHYS ENZYME IONSELECT KIN 4

Enzyme Activity and Inactivation
A Laboratory Experiment
Cowans, J. A.; Katz, S. A.
J. Chem. Educ. 42 ,553 (1965)
Ammonium ion selective electrode measures ammonia from urea hydrolysis by urease; inhibition by copper(II). pH meter and recorder.

*BIOCHEM ANAL ORG PAPERC 3 HAZARD

Chromatographic Separation and Identification of Amino Acids
Cunningham, B. A.
J. Chem. Educ. 48 ,275 (1971)
First-direction solvent: 1-butanol-MEK-H2O. Second: 1-butanol-HOAc-H2O. Each requires 5 hours for 20 cm sheet. Color developing reagents: ethanolic cyclohexylamine, ninhydrin. Hazard: Ninhydrin is a suspected carcinogen.

*BIOCHEM ANAL UVIS 3 HAZARD

Spectrophotometric Method for Determination of Glucose in Blood Serum: A freshman lab. experiment for medically and biologically oriented students
Daines, T. L.; Morse, K. W.
J. Chem. Educ. 53 ,126 (1976)
Blood serum of various concentrations of glucose treated with o-toluidine, form blue-green complex, analysis at 635 nm. HAZARD: o-toluidine is possible carcinogen.

*BIOCHEM ANAL ENZYME PAPERC QUAL 2

Demonstrating Enzymatic Hydrolysis of Glucosides by Paper Chromatography
Darling, S. F.
J. Chem. Educ. 38 ,503 (1961)
Simple beta-glucosides are hydrolyzed by beta-glucosidase; the reaction is followed with paper chromatography. Developing solution BuOH/pyridine/water or EtOAc/HOAc/water. Visualization is w. silver nitrate spray.

*BIOCHEM ORG ENZYME INTEGR PH UVIS 3

Preparation of Immobilized Enzymes, and Determination of their pH Activity Profile. An Integrated Organic-Biology Experiment.
Dejong, P. J.; Kumler, P. L.
J. Chem. Educ. 51 ,200 (1974)
Activated glass beads treated para-nitrobenzoyl chloride, reduced sodium dithionite, diazotized. Phosphate-buffered trypsin is coupled, and immobilized enzyme used to hydrolyze casein at varying pH.
Analysis by folin reagent in spec-20 at 660 nm.

*BIOCHEM ANAL DISTRIB GC PAPERC TLC 4

Analysis of Egg Lipids: A student project
DeKoning, A. J.
J. Chem. Educ. 51 ,48 (1974)
Lipids from egg yolk by chloroform extraction separated by solubility into phospolipids and non-phosphorylated. Phosphorus analysis by phosphomolybdic acid and molybdenum blue, choline ethanolamine, serine and inositol by paper chromatography. Phospholipids separated by tlc and phospholipids as methyl esters by gc.

*BIOCHEM ACBA ENZYME KIN PH 3

The Enzyme Kinetics of Phospholipase: A student experiment
DeVine, J. E.; Toom, P. M.
J. Chem. Educ. 52 ,816 (1975)
Lyophilized snake venom hydrolysis of lecithin followed by pH change. Kinetics used to find Km and Vmax. Additionally, effect of metal ions, denaturation temperature can be studied.

*BIOCHEM COLUMNC GC TECHNIQUE TLC 3 HAZARD

Isolation and Characterization of Phosphatidyl Choline from Spinach Leaves
Devor, K. A.
J. Chem. Educ. 56 ,758 (1979)
Straightforward. Designed to teach lab technique used in lipid biochemistry. Three 3-hr periods. Fatty acid esters by GC, phosphatidyl choline by silica gel TLC, extraction and chromatography uses chloroform.
HAZARD: Chloroform: carcinogen, substitute.

*BIOCHEM ANAL GELC UVIS 4 HAZARD

Student Experiments on the Gel Filtration of Proteins
Dewhurst, F.
J. Chem. Educ. 46 ,864 (1969)
Hemoglobin (prepared from blood; Caution: infection hazard) and serum solutions mixed, hemoglobin-haptoglobin complex separated on Sephadex, measured by absorption at 415 nm. Also albumin with adsorbed bromphenol blue separated from serum, measured at 605 nm. HAZARD: chloroform is a carcinogen.

*BIOCHEM INORG PORPHYRINS PREP REVIEW 4

Metal-replaced Hemoproteins. A Review with Introductory Laboratory Preparation of Cobalt Myoglobin
Dickinson, L. C.
J. Chem. Educ. 53 ,381 (1976)
Extensive discussion. Includes procedure for prep. of a cobalt protoporphyrin from human and sperm whale myoglobin. Demonstrates visible spectral changes, oxygen reversibility and oxidation.

*BIOCHEM APPARATUS BACTERIA PREP 4

Preparation of the Proteins by Micro-Organisms: A laboratory experiment
Dieteren, H. M. L.; Schouteten, A. P. H.
J. Chem. Educ. 47 ,663 (1970)
Simple reactor described. Yeast grown in nutrient mix containing normal alkanes at 30 deg., pH of 4.

*BIOCHEM DEMO PROJ UVIS 4

A Model Antigen-Antibody System for Classroom Use
Doyle, R. J.; Cronholm, L.
J. Chem. Educ. 46 ,868 (1969)
Concanavalin A from jack pine seeds as antibody, various polysaccharides as antigens. A series of demonstrations (OK for student exp't) given in outline form - more, and extensions, by references. Measurements by turbidimetry.

*BIOCHEM PHYS CHIRAL KIN NMR POLARIM 4

Applications of NMR to Biochemical Kinetics: A laboratory experiment in physical biochemistry
Drake, E. N.; Brown, C. E.
J. Chem. Educ. 54 ,124 (1977)
Alpha and beta-D-glucose mutarotation separately studied by change in nmr integration of alpha and beta anomeric protons with time and by polarimetry. Deuterium oxide (D2O) solvent.

*BIOCHEM INORG NATPROD PORPHYRIN TLC UVIS 2 3

The Chlorophylls: An experiment in bio-inorganic chemistry
Dujardin, E.; Laszlo, P.; Sacks, D.
J. Chem. Educ. 52 ,742 (1975)
Bean leaves used as source of chlorophylls. Prepn of Zn(II) and Cu(II) chlorophylls, porphin molecule. Identification by tlc, uvis fluorescence. Discussion questions.

*BIOCHEM FLUOR UVIS 5

Interaction of a Naphthalene Dye with Apohemoglobin
Fancolli, T. M.; Russo, S. F.
J. Chem. Educ. 47 ,54 (1970)
Preparation of pure hemoglobin dissociation into heme and globin, recombination, and formation and displacement of apohemoglobin-1-anilino-8-sulfonic acid complex studied by uv and filter fluorometer.

*BIOCHEM COLORIM ENZYME KIN NATPROD SEPARATION 2 3

Tyrosinase: An introductory experiment with enzymes
Friedman, M. E.; Daron, H. H.
J. Chem. Educ. 54 ,256 (1977)
Tyrosinase is extracted from foods (potatoes, etc.) with a phosphate buffer, and assayed colorimetrically by measuring the rate of conversion of 3,4-dihydroxyphenylalanine(DOPA) to DOPA-chrome.

*BIOCHEM ANAL DEMO ENZYME KIN UVIS 3

A Demonstration of Enzyme Activity For The "Sceptical Chymist"
Fried, R.; Howse, M.
J. Chem. Educ. 48 ,847 (1971)
Acetylcholineesterase acts on acetylthiocholine (substrate) in the presence of bis-dithionitrobenzoic acid (chromogen) to yield a yellow anion, which is dialyzed away from enzyme substrate. Thus, reaction can be followed colorimetrically.

*BIOCHEM PHYS INTEGR PROJ 3

Project-Oriented Physical Chemistry Experiments for Biologists: A Study of Bile Salts
Fung, B. M.; Williams, W.; Smith, R. L.
J. Chem. Educ. 55 ,198 (1978)
Bile salts used to emulsify fat, solubilize lecithin, fatty acid, cholesterol. Surface tension and micelle formation, acidity, and rate of hydrolysis (crude) also measured. Required: turbidimeter, colorimeter, tensiometer, vapor pressure osmometer.

*BIOCHEM ANAL ELECTROPHOR 3 HAZARD

Student Experiment With Filter Paper Electrophoresis
Garvin, J. E.
J. Chem. Educ. 38 ,36 (1961)
Construct 30 volt apparatus, analyze amino acids. Must switch to low-voltage isolation transformer with 24 volt secondary and general-purpose silicon rectifier (IN4004 type). Lethal shock HAZARD with setup described.

*BIOCHEM ANAL TLC 3 HAZARD

Separation of Leucine and Isoleucine by Thin Layer Chromatography
Gatto, K. L.; Borders, C. L., Jr.
J. Chem. Educ. 47 ,840 (1970)
For routine analysis of amino acids. MEK-pyridine-water-HOAc. Visualization by ninhydrin (suspected carcinogen).

*BIOCHEM BACTERIA PHARM RADIOCHEM TRACER 4

Biosynthesis of an Antibiotic: A C-14 tracer experiment
Glover, I. T.; Limbaugh, C. L.
J. Chem. Educ. 46 ,866 (1969)
Separate cultures of Aspergillus niveus are grown on media containing 1-*acetate and 2-*acetate. Citrinin isolated is degraded by base hydrolysis and CO2 produced directly and by oxidation collected as BaCO3 and counted Geiger or liq. scintillation. A relatively long and elaborate experiments. Extensions.

*BIOCHEM ANAL PHARM SOLUB UVIS 3 4 HAZARD

Solubility Relationships of Drugs and their Metabolites
Goldsmith, R. H.
J. Chem. Educ. 51 ,272 (1974)
Salicylic acid-gentisic acid, and benzoic acid-hippuric acid systems used as models to show lipophilic-hydrophilic behavior in drugs and metabolites. FeCl3-color developer; quant. Spec-20. HAZARD: CHCl3, used in extraction, is a carcinogen (avoidable).

*BIOCHEM ORG NATPROD NOPROC PROJ TLC 2 3

Natural Products: An Independent Study Project.
Griffin, R. W. .
J. Chem. Educ. 51 ,601 (1974)
Open-ended projects in extracting and classifying plant alkaloids terpenes, and flavenoids are briefly discussed.

*BIOCHEM ANAL UVIS 2 HAZARD

Serum Iron Determination: A sensitive colorimetric experiment
Harris, D. C.
J. Chem. Educ. 55 ,539 (1978)
Iron reduced (hydroxylamine) and then determined colorimetrically with ferrozine. Ultraclean glass. HAZARD: equine or human blood samples (infection hazard); trichloroacetic acid. Note: ferrozine is an ultra-sensitive reagent for Fe(II); avail. Sigma Chem. Corp.

*BIOCHEM APPARATUS ELECTROPHOR TECHNIQUE UVIS 4 5

Isoelectrical pH of Hemoglobin and Cytochrome C by Electrofocusing
Heaney, A.; Weller, D. L.
J. Chem. Educ. 47 ,724 (1970)
Technique experiment for advanced students on purification of proteins.

*BIOCHEM DIALYSIS EXCHANGE RADIOCHEM TRACER 4

A Laboratory Experiment on Exchange and Binding of Ca-45 by Serum Proteins
Hein, R. E.; Clegg, R. E.
J. Chem. Educ. 33 ,320 (1956)
Ca-45 counted after dialysis (with mild centrifuging) after equilibration of Ca-45 with serum from chicken blood or bovine albumin.

*BIOCHEM PHYS ENZYME KIN UVIS 2 3

The Hydrolysis of 4-Nitrophenyl Phosphate: A freshman class investigation
Hopkins, H. P., Jr.; Mather, J. H.
J. Chem. Educ. 49 ,126 (1972)
Hydrolysis measured colorimetrically, as function of pH, and in presence of potato phosphatase, extracted from potatoes. Activation energies from rate studies at 25 deg., 35 deg.

*BIOCHEM PHYS ENZYME KIN UVIS 3

Two Convenient Spectrophotometric Enzyme Assays: A biochemistry experiment in kinetics
Hurlbut, J. A.; Ball, T. N.; Pound, H. C.; Graves, J. L.
J. Chem. Educ. 50 ,149 (1973)
Alpha-chymotrypsin-catalyzed cleavage of N-glutaryl-1-phenylalanine-p-nitroanilide followed directly (p-nitroaniline is yellow) or by conversion of this product to an azo compound. Data used to calc. Km, Vmax, k2. Has been used successfully as a demo at RPI.

*BIOCHEM PHYS ENZYME KIN 2

Enzyme Activity Experiments Using a Simple Spectrophotometer
Hurlbut, J. A.; Kavianian, G. R.; Lee, S. Y.; Nuttall, K. L.
Gentry, S. R.; Hassman, T. L.;
J. Chem. Educ. 54 ,442 (1977)
Alpha-chymotrypsin reacts with N-glutaryl-L-phenylalanine-p-nitroanilide to produce p-nitroaniline, which is yellow. Hence the reaction may be followed spectrophotometrically (Spec 20). Determination of temperature and pH effects, Michaelis-Menton kinetics, competitive inhibition. Detailed.

*BIOCHEM ORG CLATH GC UVIS 3

The Structure and Properties of Choleic Acids: A biologically oriented experiment
Jesaitis, R. G.; Krantz, A.
J. Chem. Educ. 48 ,137 (1971)
Choleic acids are inclusion complexes of various organic compounds within deoxycholic acid. List of appropriate guest molecules given. Analysis by gc. Example procedure for the naphthalene complex.

*BIOCHEM PHOTO UVIS 5

Action of Light upon the Visual Pigment Rhodopsin : An experiment in biochemistry
Johnson, R. H.; Williams, T. P.
J. Chem. Educ. 47 ,736 (1970)
Technique experiment for advanced students. Cattle retina, dark room, electronic flash unit (I) Isolation of rod outer segments. (II) Bleaching effectiveness studied by UV, using various filters, times and intensities. Minimal procedure.

*BIOCHEM PHYS ENZYME KIN UVIS 4

Two Spectrophotometric Experiments with Alpha-Chymotrypsin
Kantrowitz, E. R.; Eisele, G.
J. Chem. Educ. 52 ,410 (1975)
Mechanism of chymotrypsin catalysis (deacylation of N-trans-cinnamoylchymotrypsin in presence of proflavine) studied using double beam spectrophotometer at 444 nm at varous pH's. Activation of chymotrypsinogen in presence of proflavine studied with Spectronic 20.

*BIOCHEM PHYS PORPHYRIN PROJ 3 4

A Study of Hemoglobin and its Subunits
Kaplan, L. J.
J. Chem. Educ. 53 ,64 (1976)
Many properties including end group analysis of subunits studied in project type experiments. Procedures by reference and by request. Techniques include electrophoresis, enzyme studies, gel and ion-exchange chromatography, viscosity, etc.

*BIOCHEM DIALYSIS MEMBRANE RADIOCHEM 4 5

Equilibrium Dialysis : A laboratory experiment
Katz, S. A.; Parfitt, C.; Purdy, R.
J. Chem. Educ. 47 ,721 (1970)
Study of the binding of Hg(II) to human serum albumin. Special dialysis cells. Radiometric assay for Hg.

*BIOCHEM ANAL RADIOCHEM TECHNIQUE TRACER 5 HAZARD

A Laboratory Introduction to Competitive Protein Binding and Radioimmunoassay
Kohl, H. H.; Wheatley, W. B.
J. Chem. Educ. 55 ,612 (1978)
Exp't designed to measure level of cortisol in serum or plasma. Liq. scintillation counter, centrifuge, incubator. Warning: blood is an infection hazard. HAZARDS: tritium requires unusual handling and safety precautions; benzene, carcinogen, substitute another solvent.

*BIOCHEM ORG PHARM PREP 3

A Multidimensional Experiment: Synthesis of a Sulfa Drug and its Use as a Chemotherapeutic Agent
Krantz, A.; Jesaitis, R. G.
J. Chem Educ. 50 ,76 (1973)
Preparation of sulfanilamide or sulfathiazole (references given) and testing on bacterial cultures (no reference given).

*BIOCHEM ORG BACTERIA GC INTEGR 3

Microbial Oxidation of Alkenes: An integrated organic-biology experiment
Kumler, P. L.; DeJong, P. J.
J. Chem. Educ. 52 ,475 (1975)
Culture of p-oleovorans used to epoxidize 1-alkenes: extraction and analysis. Shaking incubation. Epoxide content by GC.

*BIOCHEM DIALYSIS GELC IONX UVIS 3

The Purification of Cytochrome C from Bakers Yeast: An undergraduate laboratory experiment in biochemistry
Lambeth, D. O.
J. Chem. Educ. 56 ,270 (1979)
Cell lysis (on pH change, oxidation) is followed by ion exchange, dialysis, uv spectrometry, gel chromatography. Useful for large classes.

*BIOCHEM COLUMNC RADIOCHEM TRACER 4

Insulin Mediated C-14 -Glucose Incorporation into Adipose Tissue: An undergraduate biochemistry experiment
Landman, A. D.; Eskin, N. A. M.
J. Chem. Educ. 52 ,479 (1975)
Adipose tissue from sacrificed rat incubated with C-14 -glucose and insulin in shaking bath, homogenized (high speed, motor), extracted, fractionated (column chromatog) and scintillation counted.

*BIOCHEM AFFC RADIOCHEM TECHNIQUE TRACER 4

The Binding of Biotin to Sepharose-Avidin Column: Demonstration of the Affinity Chromatography Technique
Landman, A. D.; Landman, N. N.
J. Chem. Educ. 53 ,591 (1976)
Hemoglobin, riboflavin and the dye hydroxyazobenzoic acid (HABA) are eluted sequentially through the sepharose-avidin column with a bicarbonate buffer. This can be followed visually. HABA binds to the attached avidin stoichiometrically. C-14 labelled biotin releases the dye from the column. The biotin is released with guanidine-HCl and the labelled biotin counted by liquid scintillation.

*BIOCHEM AUTORAD NATPROD PAPERC PROJ RADIOCHEM TRACER 4

Sucrose-C-14 Synthesis in Castor Bean Endosperm Tissue: A tracer experiment
Larson, L. A.
J. Chem. Educ. 43 ,322 (1966)
Acetate-2 labelled (C-14) incorporated by tissue slices. Exp't follows metabolism of fats in endosperm tissue of germinating castor beans. Radioautography for sugars and amino acids. Assay by Warburg manometer-CO2 or by BaCO3 and end-window Geiger counter. Suitable for a project.

*BIOCHEM ANAL DEMO ELECTROPHOR ENZYME 2

The Electrophoresis of Indicators: An analogy to isoenzyme separation
Lavallee, D. K.; Daugherty, N. A.
J Chem. Educ. 56 ,353 (1979)
Demonstration using crude paper electrophoresis.

*BIOCHEM ANAL ORG AFFC CATALYSIS INTEGR PHOTO REDOX TLC 4

Photooxidation of Methionine: An Integrated Organic-Analytical-Biochemistry Laboratory Experiment
Lewis, C.; Scouten, W. H.
J. Chem. Educ. 53 ,395 (1976)
Methionine is photooxidized to methionine sulfoxide in the presence of immobilized methylene blue.. (1) Porous silica glass beads are activated using germania glycidoxypropyltrimethylsilane and p-nitrophenone. (2) p-nitro groups are reduced and diazotized. (3) Methylene blue is coupled to the glass. (4) Methionine is photooxidized with the treated glass as the catalyst. (5) TLC used to determine extent of oxidation.

*BIOCHEM IONX RADIOCHEM TRACER 4

Isolation and Characterization of Radioactive Adenosinetriphosphate from Mouse Muscle
Lionette, F.; Pastore, E.
J. Chem. Educ. 36 ,612 (1959)
Research report which might form the basis of a laboratory experiment. Six to eight adult mice were injected w. approx. 100 microcuries of P-32 as the sodium dihydrogen phosphate. The procedure for recovering the P-32 as ATP from the muscle is described in detail.

*BIOCHEM ENZYME KIN UVIS 4

Cytoplasm-Particle Linked Enzyme Reaction: A laboratory exercise
Litwak, G.
J. Chem. Educ. 35 ,358 (1958)
Standard biochemical laboratory apparatus. Xanthine oxidase, which catalyzes the oxidation of xanthine to uric acid, and uricase, which catalyzes the oxidation of uric acid to allantoin are studied as a linked-enzyme system. The rate of disappearance of the substrate is followed colorimetrically.

*BIOCHEM ANAL IR NATPROD PAPERC 3

Chemistry of an Insect Wing
McCullough, T.
J. Chem. Educ. 50 ,101 (1973)
Open-ended experiment begins with measuring IR spectrum of a clean, dry insect wing. Then HCl digestion, TLC, extraction, etc. This is a "first" experiment. Outline only.

*BIOCHEM INORG DIALYSIS ENZYME PREP UVIS 4 HAZARD

Carbonic Anhydrase and Metalloderivatives. A Bioinorganic Study.
McQuate, R. S.
J. Chem. Educ. 54 ,645 (1977)
Bovine carbonic anhydrase is converted to apocarbonic anhydrase by dialysis to remove Zn(II). Special precautions to remove contaminating metal ions. Spectrophotometric analysis. Two hundred thirty non-metalloderivatives prepared and analyzed by enzyme catalysis of p-nitrophenylacetate to (yellow) p-nitrophenolate. Several weeks work. Hazard: CCl4 is a carcinogen: substitute.

*BIOCHEM INORG PHYS ENZYME KIN UVIS 4

Kinetics of Formation of Cobalt(II)- and Nickel(II) Carbonic Anhydrase
McQuate, R. S.; Reardon, J. E.
J. Chem. Educ. 55 ,607 (1978)
Apocarbonic anhydrase (preparation from reference) rate of formation of Co(II) and Ni(II) complexes assayed uvis by activity in hydrolysis of p-nitrophenyl acetate.

*BIOCHEM ENZYME GELC KIN UVIS 3

Isolation of Yeast Invertase by Sephadex Gel Chromatography: A biochemistry laboratory experiment
Melius, P.
J. Chem. Educ. 48 ,765 (1971)
Chromatographic fractions analyzed for invertase activity by sucrose hydrolysis and 3,5-dinitrosalicylate reagent and for total protein by method referenced. Specific activity, and by further experiments not detailed, enzyme kinetics can be developed.

*BIOCHEM ENZYME KIN UVIS 4

Activation Energies for a Base-Catalyzed and Enzyme-Catalyzed Reaction
Miller, J. F.; Cory, J. G.
J. Chem. Educ. 48 ,475 (1971)
Hydrolysis of p-nitrophenyl phosphate catalyzed by (1) base (TRIS buffer), and (2) alkaline phosphatase as a function of temperature Reaction followed by growth of yellow color of p-nitrophenol. (410 nm) Activation energies are very different.

*BIOCHEM ANAL ELECTROPHOR 4

Determination of the Molecular Weight and Subunit Stoichiometry of a Protein: A biochemistry laboratory experiment
Moe, O. A. Jr.; Smith, G.
J. Chem. Educ. 54 ,392 (1977)
Hemoglobin, variously crosslinked with dimethylsuberimidate (prepn. from suberonitrile given) in electrophoresis on polyacrylamide gel. Requires standard molecular weight proteins, Brilliant Blue R, 2-mercaptoethanol.

*BIOCHEM ORG CONSUMERPROD ENZYME POLARIM PREP PROJ RESOLUTION 3

An Enzyme-Catalyzed Resolution of Amino Acids
Mohrig, J. R. .; Shapiro, S. M. .
J. Chem. Educ. 53 ,586 (1976)
Commercial papain is a catalyst for the stereospecific formation of an insoluble anilide from a racemic benzoylamino acid, prepared from an amino acid and benzoyl chloride. Detailed procedure given. Three lab periods. Extensions (projects) suggested.

*BIOCHEM ANAL ORG PHARM TECHNIQUE 3

A Biologically Based Evaluation of Sulfanilamide Purity: A Biological Extension of a Standard Organic Sequential Synthesis
Nelson, G. L.; Buongiorno, P. A.
J. Chem. Educ. 52 ,676 (1975)
Biochem assay. Nutrient-agar plate innoculated w. Staph. aureus and incubated. Student products tested for anti-bacterial action. Control: reagent-grade sulfanilamide.

*BIOCHEM PHYS ENZYME KIN UVIS 4

Kinetics of Carboxylesterase
Nichols, C. S.; Cromartie, T. H.
J. Chem. Educ. 56 ,832 (1979)
Effects of various factors including bis(p-nitrophenyl)phosphate, inactivator, on the rate of hydrolysis of p-nitrophenyl acetate by carboxylesterase. Recording spectrophotometer (400 nm).

*BIOCHEM PHYS ENZYME KIN UVIS 3

A Kinetic Investigation of an Enzyme-catalyzed Reaction
Nigh, W. G.
J. Chem. Educ. 53 ,666 (1976)
Fumarase (commercial) catalyzes the interconversion of fumaric acid with L-malic acid under neutral conditions without the need of cofactors. Forward and reverse reactions followed on a recording spectrophotometer. Data for 10 fumerase substrates given. Extensions suggested.

*BIOCHEM PHYS CATALYSIS DEMO ENZYME KIN 3 4

Lecture Demonstrations in Kinetics Relevant to the Biology Student
Pederson, D. M.
J. Chem. Educ. 71 ,268 (1974)
Enzyme-catalyzed hydrolysis of o-nitrophenol-(beta)-d-galactopyranoside by beta-galactosidase, followed (Spec 20) by appearance of yellow color of o-nitrophenol. Effect of temperature, substrate conc., mercury.

*BIOCHEM ENZYME MEMBRANE RADIOCHEM TRACER TRANSPORT 3 HAZARD

Active Transport of Sodium Ions Across Frog Skin
Quinney, P. R.; Swartz, H. A.
J. Chem. Educ. 41 ,159 (1964)
Na-22 chloride (end window counter) used to measure sodium ion transport. Effect of conc. gradient, lack of oxygen, cyanide ion measured. Not difficult. Hazard: cyanides

*BIOCHEM ENZYME KIN 2

Bromolain: Experiments illustrating proteolytic enzyme action
Reigh, D. L.
J. Chem. Educ. 53 ,386 (1976)
Effects on gelation of Jello of the enzyme bromolain obtained from fresh pineapple. Requires centrifuging. Also effect of heat, cold, pH, heavy metal ion and sulfhydryl inhibitors. Extension to other enzymes suggested.

*BIOCHEM DIALYSIS ENZYME EXOBIO KIN UVIS 3

Thermal Proteinoids: A project in molecular evolution for the undergraduate biochemistry laboratory
Rhodes, G. W.; Flurkey, W. H.; Shipley, R. M.
J. Chem. Educ. 52 ,197 (1975)
Proteinoides from amino acid (16 neutral and basic plus aspartic and glutamic) at 170-180 degrees, dialyzed, and activity (hydrolysis of paranitrophenyl acetate) compared with that of chymotrypsin.

*BIOCHEM ELECTROPHOR ENZYME 3

Polyacrylamide Gel Electrophoresis of Yeast Invertase: A biochemistry laboratory experiment
Roberts, C. A.; Jones, C.; Spencer, E. J.; Bowman, G. C.; Blackman, D.
J. Chem. Educ. 53 ,62 (1976)
Yeast invertase purification on sephadex or biogel described separately is followed by gel electrophoresis of crude and partially purified materials. Assay by hydrolysis of sucrose acetate and color reaction with 3,5-dinitrosalicylate.

*BIOCHEM ENZYME KIN UVIS 3

The Mechanism of Action of Salivary Amylase: A simple undergraduate experiment
Rungrruangsak, K.; Panijpan, B.
J. Chem. Educ. 56 ,423 (1979)
Saliva hydrolysis of potato starch solution followed by reaction of maltose with dinitrosalicylic acid. Kinetics used to establish mechanism.

*BIOCHEM ANAL ENZYME FLUOR 4

Two Fluorescence Experiments
Russo, S. F.
J. Chem. Educ. 46 ,374 (1969)
Fluorescence quantum yield of unknown (fluorescein) by comparison with fluorescence excitation spectrum of quinine. Fluorescence labeling of protein uses 2-p-toluidinylnaphthalene-6-sulfonate and chymotrypsin.

*BIOCHEM ENZYME KIN UVIS 3

The Activity of Trypsin
Russo, S. F.; Holzman, T.
J. Chem. Educ. 54 ,60 (1977)
Trypsin activity measured by hydrolysis of methylated casein. Rates used to calculate specific, molar, and catalytic center activity.
Trinitrobenzenesulfonic acid.

*BIOCHEM DEMO PORPHYRIN UVIS 2

Hemoglobin: Isolation and chemical properties
Russo, S. F.; Sorstokke, R. B.
J. Chem. Educ. 50 ,347 (1973)
Oxyhemoglobin solution isolated from lysed blood cells, visible spectrum examined after reaction with ferrous sulfate, ferricyanide, nitrite, and pH variation.

*BIOCHEM PHYS ENZYME KIN UVIS 4 HAZARD

Oetermination of Rate Constants for Ouabain Inhibition of Adenosine Triphosphatase: An undergraduate biological chemistry laboratory experiment
Sall, E.; Givens, C. D.; Taylor, R. P.; Grisham, C. M.
J. Chem. Educ. 55 ,122 (1978)
ATP-ase (from sheep kidney), activity measured uvis by NAD^+ produced in coupled enzyme reactions of pyruvate kinase and lactate dehydrogenase.
HAZARD: ouabain is an extremely toxic heart and nervous system poison.

*BIOCHEM APPARATUS COMPUTER KEQ PORPHYRIN UVIS 5

Demonstration of Allosteric Behavior: The hemoglobin-oxygen system
Sawyer, W. H.
J. Chem. Educ. 49 ,777 (1972)
Diagram of a simple apparatus for equilibrating hemoglobin with known partial pressures of oxygen (tonometer). Evans Electroselenium Colorimeter, 600 nm filter. The point of the experiment is to demonstrate allosteric characteristics and the effect of modifiers such as protons and organic phosphates. Thermodynamic interpretation allows computer simulation of binding phenomenon.

*BIOCHEM ELECTROPHOR EXOBIO PAPERC 3

A Biochemistry Laboratory Experiment
Scher, I.; Walsh, E.; Kadis, B.
J. Chem. Educ. 38 ,632 (1961)
Miller experiment. Amino acids from electric discharge in natural gas. Special glass apparatus.

*BIOCHEM ANAL FLUOR NATPROD VITAMIN 3

Excretion of Ingested Ascorbic Acid: An easy interesting undergraduate experiment
Sirota, G. R.; Macinnis, W. K.; Rasmussen, P. W.
J. Chem. Educ. 56 ,421 (1979)
React o-phenylenediamine, measure filter fluorometer.

*BIOCHEM NOPROC PORPHYRIN PROJ 5

Hemoglobin as a System for Laboratory Study
Splittgerber, A. G.
J. Chem. Educ. 51 ,402 (1974)
Centrifuging, lysis, dialysis gives stock hemoglobin solution. Use for pH titrations, viscosity, electrophoresis, tyrosine and tryptophan analysis (uvis), paper and column chromatography, oxygen binding by Warburg, magnetic susceptibility, molecular weight by iron analysis, kinetics of autoxidation to methemoglobin.

*BIOCHEM PHYS AFFC KIN UVIS 3

The Kinetics and Inhibition of the Enzyme Methemoglobin Reductase: A biochemistry experiment
Splittgerber, A. G.; Mitchell, K.; Puffer, G. D. M.; Blomquist, K.
J. Chem. Educ. 52 ,680 (1975)
Washed (centrifuge) red blood cells lysed in water. Crude enzyme on DEAE cellulose, extracted, assayed by reduction of 2,6-dichlorophenol indophenol in presence of NADH. Kinetics studied also with salicylate inhibition.
Michaelis-Menton kinetics. For DEAE cellulose, ref. J. Biol. Chem (1962).

*BIOCHEM PHYS APPARATUS NUCL.ACID UVIS 3

The Helix-Coil Transition of DNA: Observed With an Inexpensive UV Photometer
Steinert, R.; Hudson, B.
J. Chem. Educ. 50 ,129 (1973)
DNA in random coil absorbs approx. 40% more intensely than in double helix at 260 nm. Increase usually occurs 60-100 deg. C. Expt. requires UV photometer with var. temp. cell - design given. Calf thymus DNA.

*BIOCHEM EXOBIO 2 3

A "Primordial Biogenesis" Experiment
Steinman, G.; Smith, A. E.
J. Chem. Educ. 45 ,555 (1968)
Formaldehyde and ammonium thiocyanate react to form dynamic microscopic bodies, by incubation or UV irradiation. Elements of structure. Little explanation.

*BIOCHEM PHYS KEQ KIN UVIS VITAMIN 3

Thermodynamics and Kinetics of Ligand Binding to Vitamin B12a: A laboratory experiment
Sweigart, D. A.
J. Chem. Educ. 52 ,126 (1975)
Keq for Vitamin B12a reaction with SCN measured uvis. Also rate constants measured by stopped flow used to calculate Keq.

*BIOCHEM DEMO ENZYME 4

A Simple Method for Demonstrating an Enzymatic Reaction
Tang, C. S.
J. Chem. Educ. 47 ,692 (1970)
Papaya seeds. Caution: taste test, probably OK as a demo well away from the lab, but be sure of the origin of seeds.

*BIOCHEM ANAL CHROMATOG ENZYME TLC UVIS 3

Enzymatic and Colorimetric Determination of Total Serum Cholesterol: An undergraduate biochemistry laboratory experiment
Taylor, R. P.; Broccoli, A. V.; Grisham, C. M.
J. Chem. Educ. 55 ,63 (1978)
Blood serum incubated with mixed enzymes (cholesterol ester hydrolase, cholesterol oxidase, peroxidase) and phenol and 4-aminoantipyrene. Optical density at 500 nm measured (standardized with cholesterol). Alternative: serum plus Liebermann-Burchard reagent, optical density at 625 nm. Enzyme assay products examined with tlc.

*BIOCHEM AFFC ELECTROPHOR ENZYME KIN NOPROC TECHNIQUE UVIS 4

Affinity Chromatography of Lactate Dehydrogenase: A biochemistry experiment
Taylor, S. S.; Dixon, E.
J. Chem, Educ. 55 ,675 (1978)
AMP-sepharose prepared or available commercially used to isolate a family of enzymes (dehydrogenases), separated from beef heart or rabbit muscle. Separation of lactate dehydrogenase by elution with NADH-pyruvate adduct. Enzyme assay by NADH oxidation (uvis) in presence of pyruvate. Molecular weight by gel electrophoresis or sephadex column chromatog. Kinetics and electrophoresis to distinguish isoenzymes.

*BIOCHEM ANAL PHYS ENZYME KIN UVIS 3

Determination of Glucose: A kinetics experiment for the analytical course
Toren, E. C., Jr.
J. Chem. Educ. 44 ,172 (1967)
Glucose oxidase, followed by horseradish peroxidase-o-dianisidine reaction used for kinetic data; two methods of analyzing data give glucose concentration.

*BIOCHEM ORG BACTERIA ENZYME INTEGR PHARM PREP TLC 3

The Microbial Hydroxylation of Progesterone: An organic-biological experiment involving a reaction important to the pharmaceutical industry
Volker, E. J.
J. Chem. Educ. 54 ,65 (1977)
Culture of Rhizopus nigricans hydroxylates 10-100 mg of progesterone, determined by tlc or recrystallization and ir, requires autoclave shaker.

*BIOCHEM ORG BACTERIA CHIRAL POLARIM PREP 3

The Microbial Conversion of D-Sorbitol to L-Sorbose: An interdisciplinary experiment illustrating an industrial process
Volker, E. J.; Shultz, C.
J. Chem. Educ. 55 ,673 (1978)
Acetobacter suboxydans culture used to oxidize D-sorbitol. Aliquots withdrawn for polarimetry.

*BIOCHEM ANAL ACBA NMR TITN 4

Titration of Alanine Monitored by NMR Spectroscopy: A Biochemistry Laboratory Experiment
Waller, F. J.; Hartman, I. S.; Kwong, S. T.
J. Chem. Educ. 54 ,447 (1977)
Simultaneous monitoring of pH and NMR proton shifts during the acid-base titration of alpha- and beta-alanine. Calculation of pK(NH3+) values.

*BIOCHEM COLUMNC ENZYME GC TLC 3 HAZARD

Egg Yolk Lecithin: A biochemical laboratory project
White, B. J.; Tipton, C. L.; Dressel, M.
J. Chem. Educ. 51 ,533 (1974)
Phosphatide mixture by solvent extraction analyzed by tlc. Lecithin separated column chromatography. Hydrolysis with phospholipase-A (snake venom - HAZARD) and by KOH followed by esterification (BF3-methanol) for gc analysis of fatty acids.

*BIOCHEM PHYS ENZYME NUCL.ACID PROJ UVIS 4 HAZARD

Isolation and Characterization of Bacterial DNA: A project-oriented laboratory in physical biochemistry
Wilson, W. D.; Davidson, M. W.
J. Chem. Educ. 56 ,204 (1979)
Frozen E. coli B cells (commercially available), treated lysozyme, sodium lauryl sarcosine, proteinase K, and DNA separated by centrifuge, treated ribonuclease A, extracted with phenol (hazard) and separated by centrifuge, dialyzed and analyzed by uvis. Characterizations (described by reference) includes uvis spectrum, helix-coil transition temperature and hyperchromicity, RNA determination, gel electrophoresis and viscosity.

*BIOCHEM ENZYME KIN 6

Determination of the Kinetic Constants in a Two-Substrate Enzymatic Reaction
Yap, W. T.; Howell, B. F.; Schaffer, R.
J. Chem. Educ. 54 ,254 (1977)
Research report. Kinetics of the reaction of pyruvate with reduced nicotinamide adenine dinucleotide (NADH) catalyzed by the enzyme lactate dehydrogenase (LDH) studied. A method is given for the analysis of that part of the kinetic data which involves initial velocities as a function of substrate concentration. This provides an accurate method of determining kinetic constants in two-substrate enzymatic reactions.

*INORG COORD PREP PROJ UVIS 2

The Synthesis and Reactions of a Cobalt Complex: A project for freshman laboratory
Alexander, J. J.; Dorsey, J. G.
J. Chem. Educ. 55 ,207 (1978)
Tetraamminecarbonatocobalt(III) complex from cobalt nitrate followed by reaction with unknown strong acid to yield compound identifiable from vis spectrum.

*INORG PHYS DEMO GAS KEQ PREP 2

Gas Laws, Equilibrium, and The Commercial Synthesis of Nitric Acid: A simple demonstration
Alexander, M. D.
J. Chem. Educ. 48 ,838 (1971)
Simple apparatus. Reactant gases are NO and O2.

*INORG ORG NMR ORGANOMETAL PREP 4 HAZARD

Synthesis and NMR Spectrum of Triphenyltin Hydride
Allen, C. W.
J. Chem. Educ. 47 ,479 (1970)
Tetraphenyl tin and anhy. SnCl4 form triphenyltin chloride. Reduction in anhy. NH3 with Li gives product; dist. at 0.1mm. HAZARD: tin toxicity, liq. NH3, lithium metal.

*INORG ORG IR MASSPEC NMR ORGANOMETAL PREP 4 5 HAZARD

Preparation and Characterization of Mesitylene Tricarbonyl Molybdenum (O): An experiment in organometallic chemistry
Angelici, R. J.
J. Chem. Educ. 45 ,119 (1968)
From molybdenum hexacarbonyl. Lower-cost prep for senior lab course. The compound is prepared, purified, and examined by ir, nmr, etc.Caution: highly reactive, toxic materials.

*INORG APPARATUS COORD GAS NONAQ PREP 4

Oxygen Uptake by a Cobalt(II) Complex: An Undergraduate Experiment
Appleton, T. G.
J. Chem. Educ. 54 ,443 (1977)
Simple apparatus described for measuring the oxygen uptake of the N,N'-bis(salicylaldehyde)ethylenediimino complex of Co^{++} in DMSO. Preparations are given both for the complexing agent and the complex.

*INORG ORG COMPLEX EXCHANGE NMR ORGANOMETAL PREP 4 5 HAZARD

Exchange Reactions by NMR Without Variable Temperature: An Experiment Using Allyl-Palladium Complexes
Appleton, T. G.; Cotton, J. D.
J. Chem. Educ. 55 ,131 (1978)
Prep. of Na2PdCl4-(Pd(Pi-(C4H7)Cl)2 and Pd(Pi-C4H7)Cl-P(C6H5)3 from palladium sponge. Pi-allyl system from methallyl chloride. Nmr spectrum changes with (Pd/P) ratio. HAZARD: carbon monoxide (toxicity).

*INORG DTA MAGNETIC NOPROC PHOTO PREP PROJ 4

Preparation and Properties of Potassium Trioxalatoferrate(III) Trihydrate: a Laboratory Exercise
Aravamudan, G.; Gopalakrishnan, J.; Udupa, M. R.
J. Chem. Educ. 51 ,129 (1974)
Describes use of compound named in title as basis of graduate school project. No details, but ref. to J. Chem. Educ. 47, 702(1970) for preparation. Within capacity of many university freshmen.

*INORG DEMO REDOX 2

A Lecture Demonstration of the Various Oxidation States of Manganese
Arora, . C. L.
J. Chem. Educ. 54 ,302 (1977)
Demonstration solutions of less common valences are prepared by reacting the more common ones; e.g., Mn(III) is prepared by mixing MnO4- and Mn(II) in conc. H2SO4. Detailed presentation of the relevant half-reactions.
A tested demonstration.

*INORG ORG DEMO MAGIC 1

Producing a Chemistry Magic Show
Bailey, P. S.; Bailey, C. A.; Anderson, J.; Koski, P. G.; Rechsteiner,
J. Chem Educ. 52 ,525 (1975)
Demonstration suggestions, some new.

*INORG ORG COORD INTEGR MAGNETIC PREP SEQ 4 HAZARD

Electronic Properties of Manganese Isocyanide Complexes by NMR
Bailey, R. A.
J. Chem. Educ. 49 ,297 (1972)
Synthetic sequence begins with prep'n of pure MnI2.2H2O from MnCO3 and anhydrous HI; and prep'n t-butyl isocyanide from t-butyl formamide. Hexakis(t-butylisocyanide)Mn(I) nitrate and hexakis(t-butylisocyanide)-Mn(II)fluorophosphate prep'd, and magnetic moments measured. Does not require vacuum line or inert atmosphere.
Hazard: highly exothermic POCl3 reaction - not for beginners.

*INORG ELECTROANAL ISOMERS PREP TITN UVIS 3 HAZARD

The Hydration Isomers of Chromium(III) Chloride
Barbier, J. P.; Kappenstein, C.; Hugel, R.
J. Chem. Educ. 49 ,204 (1972)
Commercial and two other (prepared) isomers examined : spectra, conductance, chloride ion (by mercurimetric titn) concn. HAZARD: HCl(gas).

*INORG GLOVEB ORGANOMETAL PREP PROJ SEQ 4 HAZARD

Nickel Complexes With Organic and Phosphorous Ligands: an Integrated Set of Inorganic Experiments
Barnett, K. W.
J. Chem. Educ. 51 ,422 (1974)
Nickelocene, etc. synthesis. Preparation details are given, but little on characterization. HAZARD: highly toxic compounds. Extensions suggested, no details.

*INORG DEMO GAS SOLUB 2

The Solubility of Ammonia
Barrett, R. L.
J. Chem. Educ. 36 ,A61 (1959)
Variation on the ammonia fountain. A Chem-Ed Tested Demo.

*INORG DEMO PREP 2

Preparation of Chromate, Manganate, and Permanganate
Barrett, R. L.
J. Chem. Educ. 36 ,A68 (1959)
A Chem-Ed Tested Demo. MnO2, Cr2O3 fused with NaOH-KNO3 , and the cooled mass dissolved in water to show (yellow) chromate ion, (green) manganate ion. Acidification of the manganate solution with HNO3 (6M) will result in its conversion to (purple) permanganate.

*INORG ELECTROCHEM REDOX 2

Anodizing Aluminum: An Electrolytic Oxidation Experiment For General Chemistry
Blatt, R. G.
J. Chem. Educ. 56 ,268 (1979)
Author proposes anodization 10 V DC in 28% sulfuric acid, coloring anodized surface w. bright fabric dyes. Reader (VC) says 28% sulfuric does not work, but 10% is all right. Bibliographers suggest use of basic electrolyte.

*INORG ACBA DEMO 1 HAZARD

Chromate Dichromate Equilibrium
Bohning, J. J.
J. Chem. Educ. 37 ,A44 (1960)
Dichromate and chromate solutions are reacted with H^+, OH^-, Ag^+, and Ba^{++}, to demonstrate the ($2CrO_4^=/Cr_2O_7^=$) acid-base equilibrium. A Chem. Ed. Tested Demo. HAZARD. Cr(+6) is a carcinogen.

*INORG MISTAKE PREP REDOX 3 HAZARD

Isolation of Uranium by Reduction of Uranyl Acetate
Bonsper, T.
J. Chem. Educ. 53 ,515 (1976)
Simple apparatus, complex reaction. Step 1, UO_3 from uranyl acetate by calcium reduction. Step 2. Reduction to metal with carbon. HAZARDS: radioactivity; use of sodium if calcium is not sufficient to reduce; one disposal method is wrong.

*INORG DEMO NAME THERMO 2 HAZARD

The Thermite Lecture Demonstration
Bozzelli, J. W.; Barat, R. B.
J. Chem. Educ. 56 ,675 (1979)
Straightforward. Two modifications to standard set-up to make implementation simpler, and to increase audience accessibility. HAZARD: glycerol-permanganate igniter (explosive hazard).

*INORG DEMO PREP 2 HAZARD

Preparation of White Phosphorus From Red Phosphorus
Brodkin, J.
J. Chem. Educ. 37 ,A93 (1960)
By heating red phosphorus in a test tube. White phosphorus condenses on a cold-finger. A Chem-Ed Tested Demo. HAZARD: white phosphorus is highly toxic, gives bad burns, and is a storage and disposal hazard. This demo is not suitable for adaptation to a student experiment.

*INORG ANAL COORD NOPROC PREP REDOX SEQ 2

An Experiment Sequence Involving Potassium Trioxalatoferrate(III) Trihydrate
Brooks, D. W.
J. Chem. Educ. 50 ,218 (1973)
Describes exp. seq. for prep and anal. Zn-dust reduction avoids Hg waste.

*INORG DEMO 2 HAZARD

Reduction of Cupric Ion by White Phosphorus
Bryce, W. A.
J. Chem. Educ. 35 ,A26 (1958)
A Chem-Ed Tested Demo. HAZARD: white phosphorus is toxic and generally considered a dangerous substance. (burns, storage hazard). This demo is not suitable for adaptation to a student experiment.

*INORG COORD NOPROC PREP SEQ 3

Multipurpose Coordination Chemistry Experiment for Undergraduates
Burmeister, J. L.
J. Chem. Educ. 44 ,768 (1967)
3-step synth. of $K_3[Co(CN)_5SCN]$ requires student to follow lit. directions and modify them. No characterization except grav. anal. and ir mentioned.

*INORG ELECTROCHEM PROJ 4 HAZARD

Recovery of Silver From Laboratory Wastes
Bush, K. J.; Diehl, H.
J. Chem. Educ. 56 ,54 (1979)
Electrodeposition from cyanide solution. Suitable for student project, with care. HAZARD: cyanides, cyanogen (possible).

*INORG CORROSION DEMO REDOX 2

Controlled Corrosion of Iron
Byrne, R.
J. Chem. Educ. 36 ,A41 (1959)
A Chem-Ed Tested Demo. Visualization of products of corrosion of iron by surrounding iron electrodes with a agar gel doped with $K_3Fe(CN)_6$ and phenolphthalein ("ferroxyl indicator").

*INORG COORD DEMO KIN REDOX 2 HAZARD

Illustration of d and p Block Element Properties
Canty, A. J.
J. Chem. Educ. 55 ,790 (1978)
Soln of AgCl in NH_3, NaCN (aq), and reduction of complexes to free metal. HAZARD: Cyanides.

*INORG ORGANOMETAL PREP TLC 4 5 HAZARD

Organometallic Chemistry of Mercury - An Undergraduate Experiment
Canty, A. J.
J. Chem. Educ. 51 ,750 (1974)
Phenyl mercuric halides prepared from benzene by mercuric acetate reaction, TLC in detail. Characterizations (ir, nmr) mentioned.
HAZARD: toxic compounds, disposal problems, carcinogens.

*INORG STOICH 2

The Determination of the Combining Weight of Tin
Carmody, W. R.
J. Chem. Educ. 44 ,415 (1967)
Modified procedure for an old experiment gives results to 1%.

*INORG STOICH 1

A Study of the Silver Tree Experiment
Carmody, W. R.; Wiersma, J.
J. Chem. Educ. 44 ,417 (1967)
Systematic errors leading to poor results in the CHEMS program analyzed and a modified apparatus and procedure suggested.

*INORG DEMO PREP 2 HAZARD

The Aluminothermic Process: A variation
Chakoumakos, C.
J. Chem. Educ. 36 ,A21 (1959)
A Chem-Ed Tested Demo. Thermite reaction under safer conditions than was common in 1959, but still not very safe. HAZARD: high temperature, possible explosion.

*INORG PREP STOICH 1

The Relationship of Lead and Sulfur in a Chemical Reaction
Chapman, V. L.
J. Chem. Educ. 54 ,436 (1977)
Direct combination of the elements. Teaching suggestions. Caution: Sulfur dioxide vapor evolved - perform in hood.

*INORG GLASS HITEMP SOLID 2 3

Raku: A Redox Experiment in Glass Chemistry
Cichowski, R. S.
J. Chem. Educ. 52 ,616 (1975)
Raku is an old Japanese ceramic process-colored and decorative surface on glass by reduction of copper or silver. Requires muffle furnace in hood. A nice combination of chemistry and art. Caution: high temperature work requires spec. precautions.

*INORG PHYS DEMO ELECTROCHEM PREP 2

Preparation of Sodium by Electrolysis of Solid Sodium Hydroxide
Ciparick, J. S. J.
J. Chem. Educ. 37 ,A35 (1960)
A Chem-Ed Tested Demo; requires an electrolysis demonstration apparatus, Cu electrodes, 120 volt DC source.

*INORG ANAL NOPROC PREP 3

A Study of Ammonium Carbamate: A Student Project
Clifford, C. W.
J. Chem. Educ. 43 ,104 (1966)
Preparation from ammonia (gas and liquid) and CO2 (gas), and from NH3 (liquid) and CO2 (solid). Analysis by absorption in sulfuric acid and sodium hydroxide.

*INORG PREP SEQ 2

Near 100% Student Yields With The "Cycle of Copper"
Condike, G. F.
J. Chem. Educ. 52 ,615 (1975)
Seq. is: Cu converted to Cu(NO3)2 by dissolving in acid, to Cu(OH)2 by reaction with NaOH, etc. back to Cu. Description only - v. few details.
WARNING: assorted standard hazards, such as conc. acids (e.g., H2SO4, HNO3), H2 evolution, etc., not identified. Insufficient detail for beginners.

*INORG ELECTROCHEM HITEMP PREP STOICH VACTEK XRAY 4 5

The Preparation and Characterization of Sodium Tungsten Bronze
Conroy, L. E.
J. Chem. Educ. 54 ,43 (1977)
Tungsten bronze by electrochem or chemical reduction in melt (crucible furnace). Characterization by x-ray, quantitative oxidation, volatilization as WO2Cl2 (vac system).

*INORG ACBA DEMO GAS 1

Acid-Base Reactions in the Gaseous State
Corso, C. R.; DeOliveira, J. E.
J. Chem. Educ. 55 ,244 (1978)
HCl and ammonia. Simple apparatus.

*INORG COORD EDTA KEQ NMR 5

Temperature Dependent Magnetic Measurements and Structural Equilibria in Solution
Crawford, T. H.; Swanson, J.
J. Chem. Educ. 48 ,382 (1971)
Research report. Mag. moment and equilibrium data for certain acetylacetone, salicyl, and EDTA complexes of first row transition elements at varying temperatures. Variable temp. probe. See also Deutsch, J.L.; Poling,S.M., J. Chem. Educ. 46, 167(1969).

*INORG ANAL APPARATUS COORD KIN PREP UVIS 3 HAZARD

An Introductory Chemistry Synthesis and Kinetics Experiment
Crumbless, A. L.
J. Chem. Educ. 53 ,528 (1976)
Prep'n and characterization of (Co(NH3)5N3)Cl2; rate of its reduction by iron(II) followed colorimetrically. HAZARD: azides are storage and disposal hazards (explosion, toxicity).

*INORG PREP REDOX 2 HAZARD

The Chemistry Involved in the Preparation of a Paint Pigment: An experiment for the Freshman Laboratory
Daines, T. L.; Morse, K. W.
J. Chem. Educ. 53 ,117 (1976)
Prepn of PbCrO4 from chromium(III) nitrate. Explicit details.
HAZARD: Chromium(VI) compounds are carcinogenic.

*INORG ANAL COORD DTA HITEMP PREP 3

Thermal Decomposition of Potassium Bisoxalatocuprate (II) Dihydrate: An Inorganic Analytical Experiment.
Darley, J. R.; Hoppe, J. I.
J. Chem. Educ. 49 ,365 (1972)
Preparation, thermal decomposition (muffle furnace, 500 deg. C.) and analysis of pure salt and decomposition products by a variety of techniques; eg, edta titration, gravimetry

*INORG ANAL AA IONX 3

Hydrolysis of a Chromium(III) Complex Using Atomic Absorption and Ion Exchange
Davies, M. B.; Lethbridge, J. W.
J. Chem. Educ. 50 ,793 (1973)
Hydrolysis of oxalato-bis(ethylenediamine)chromium(III)bromide, sepn on cation exchanger, atomic absorption analysis. Two 3 hr. lab periods.

*INORG ANAL PREP REDOX TITN 3

Oxidation States of Vanadium
Davis, J. M.
J. Chem. Educ. 45 ,473 (1968)
A modification of the experiment in which various oxidation states of vanadium are produced and analyzed. Reduction of ammonium vanadate; MnO4(-) titration. Somewhat confusing.

*INORG ANAL PREP STOICH 2

The Stoichiometry of Copper Sulfide Formed in an Introductory Laboratory Exercise
Dingledy, D.; Barnard, W. M.
J. Chem. Educ. 44 ,242 (1967)
The use of Cu2S synthesis to demonstrate law of constant proportions is poor pedagogy because, at temperatures used, composition is variable due to formation of solid solutions of Cu9S5 in Cu2S.

*INORG PHYS DEMO THERMO 2

A Demonstration of Burning Magnesium and Dry Ice.
Driscoll, J. A.
J. Chem. Educ 55 ,450 (1978)
Thermodynamics predicts that magnesium metal should react with CO2 (enthalpy negative). Reaction goes spectacularly. Product is a black mass of charcoal in a white crust of MgO. Caution: Protect eyes against intense light and possible hot particles. A tested demonstration.

*INORG DEMO ENVIRON UVIS 2 HAZARD

Ultraviolet Absorption of Ozone
Driscoll, J. A.
J. Chem. Educ. 54 ,675 (1977)
Reports successful use of an ozone generator and UV light source to demonstrate that ozone will absorb ultraviolet light whereas O2 will not. HAZARDS: Electric discharge, UV and ozone.

* NORG ANAL ASPIRIN COORD EDTA ELECTROCHEM PREP PROJ UVIS 2

A Copper (II) Aspirinate Project for the General Chemistry Laboratory.
Dudek, E.
J. Chem. Educ. 54 ,329 (1977)
Synthesis of the compound and its analysis by various methods (electrodeposition, EDTA titration, and colorimetry with ethylenediamine, etc.)
Method of continuous variation shows two possible complexes.
Outline only.

*INORG COURSE PREP PROJ 4 HAZARD

Inorganic Reaction Chemistry: A course combining practical work with book work
Dudeney, A. W. L.
J. Chem. Educ. 48 ,376 (1971)
Outline of a course to teach inorganic reactions, not in the United States.
HAZARD: many of the reagents are carcinogens or suspected carcinogens. Especially dangerous are the Be^{++} salts, which should never be issued to undergraduate students.

*INORG DEMO EXPLOSION KIN REDOX 1 HAZARD

Spontaneous Combustion: Acetylene
Dunbar, R. E.
J. Chem. Educ. 35 ,A29 (1958)
A Chem-Ed Tested Demo. Calcium carbide, sodium hypochlorite, HCl.
HAZARD: explosive hazard.

*INORG ANAL COORD PREP UVIS 3 HAZARD

Spectra of Cr(III) Complexes: An Inorganic Chemistry Experiment.
Dunne, T. G.
J. Chem. Educ. 44 ,101 (1967)
Ethylenediamine; 2,4-pentanedione. Crystal field splitting. Recording spectrophotometer.
HAZARD (avoidable): Benzene - carcinogen.

*INORG COORD MAGNETIC UVIS 3

Magnetic Moment Measurement of a Coordination Complex
Dunne, T. G.
J. Chem. Educ. 44 ,142 (1967)
Prep'n (by ref.) of $K_3Fe(C_2O_4)_3.3H_2O$; mag. suscept. by direct measure (magnet. Gaussmeter) or by calibration with $HgCo(CNS)_4$. Visible spectrum.

*INORG ANAL ACBA DEMO ELECTROANAL 1

The Removal of Ions by Metathesis Reactions
Dutton, F. B.
J. Chem. Educ. 35 ,A53 (1958)
Titration of $Ba(OH)_2$ with H_2SO_4 followed with a simple conductivity apparatus (40-watt lamp with electrodes). A Chem-Ed Tested Demo.

*INORG DEMO REDOX 1 2 HAZARD

Oxidation of Bromide and Iodide Ions
Dutton, F. B.
J. Chem. Educ. 40 ,A24 (1963)
Simple redox reactions show as color changes in CCl_4 (HAZARD: carcinogen, substitute less hazardous methylene chloride).

*INORG DEMO REDOX 2

Oxidation States of Transitional Elements - Vanadium
Dutton, F. B.
J. Chem. Educ. 36 ,A41 (1959)
In situ reduction of vanadate by zinc amalgam. A Chem-Ed Tested Demo.

*INORG APPARATUS DEMO IONX WATERCHEM 2

Hard Water, Water Softening, Ion Exchange
Egen, N.; Ford, P. C.
J. Chem. Educ. 53 ,302 (1976)
Simple apparatus (constr. details given) for prep. of deionized tap water using ion exchange resin, plus simple tests (sudsing, elec. cond.) for hardness. A tested demonstration.

*INORG COORD NMR PHOTO PREP PROJ UVIS 5

Synthesis, Characterization, and Photogeneration of 2-Methylpyrazinepentacyanoiron(II) Complex
Ernhoffer, R.; Kovacs, D.; Subak, E., Jr.; Shepherd, R. E.
J. Chem. Educ. 55 ,610 (1978)
Starting materials: $Na_2(Fe(CN)_5NO).2H_2O$ and 2-methylpyrazine. Compound in title prepared (1) by thermal synthesis, and (2) photochemically and characterized uvis, nmr.

*INORG ANAL PHYS ACBA COORD ELECTROANAL PREP PROJ UVIS 3

Physical and Chemical Properties of the Copper-Alanine System:
An Advanced Laboratory Project
Farrell, J. J.
J. Chem. Educ. 54 ,445 (1977)
Intended for biology majors course in "Physical Chemistry of the Life Sciences". Project includes titration, determination of equilibrium constants, use of the spectrophotometer, etc Minimal directions. Within capacity of many freshman.

*INORG REDOX 1 2

Studying the Chemical Properties of Metallic Aluminum
Feifer, N.
J. Chem. Educ. 45 ,648 (1968)
Aluminum amalgam reacts water, aq. metal salts in test tube redox reactions.

*INORG DEMO NOPROC PROJ 2 3 HAZARD

The Ammonium Dichromate Volcano as an Introductory Laboratory Project
Finholt, J. E.
J. Chem. Educ. 47 ,533 (1970)
The usual demo translated into a project to analyze reaction or products. HAZARD: chromium(VI) compounds are carcinogens. Unless care and hood are used, some dichromate gets into the air.

*INORG COORD GEOM KIN UVIS 2

Isomerism in Transition Metal Complexes: An experiment for freshman chemistry laboratory
Foust, R. D., Jr.; Ford, P. C.
J. Chem. Educ. 47 ,165 (1970)
Cobalt(III) ethylenediamine complexes. Prep'n of the green cis- and purple trans-. Rates of isomerization followed spectrophotometrically.

*INORG ANAL PHYS COMPLEX NMR STOICH TITN 4

A Proton Magnetic Resonance Coordination Number Study: AlCl3 in Aqueous Solvent Mixtures
Fratiello, A.; Schuster, R. E.
J. Chem. Educ. 45 ,91 (1968)
Nmr variable temp. probe (-20 deg.) to determine bound and free water. Requires accurate chloride (titr) det'n.

*INORG DEMO ELECTROCHEM MOLTENSALT PREP 2 HAZARD

Preparation of Metallic Lithium
Geffner, S. L.
J. Chem. Educ. 38 ,A41 (1961)
Electrolysis of molten LiCl. HAZARDS: 1) LiCl is somewhat toxic. 2) While the theory of this experiment is easily within the grasp of the students at level 2 (or 1), the technique is not. Specifically, there are high temp. hazards, such as "spitting" if the LiCl is not completely anhydrous, and there are also electrical hazards. A Chem-Ed Tested Demo.

*INORG COMPLEX DEMO ELECTROCHEM 2

Silver Plating From an Iodide Complex
Geffner, S. L.
J. Chem. Educ. 38 ,A41 (1961)
AgNO3/KI solution. The plate is said to be excellent; it may be buffed to a high luster. A Chem-Ed Tested Demo.

*INORG PHYS DEMO LUMIN PREP 3 HAZARD

Triboluminescence of New Uranyl Salts
Gil, J. M.; Gil, F. J. M.
J. Chem. Educ. 55 ,340 (1978)
Assorted double salts of Be, Sr, Ba, Ni, etc. and uranyl (acetate, sulfate, oxalate), prepn mostly by reference, are triboluminescent. This article discusses 3 alternative exitation mechanisms. TL is excited by crushing crystals in the dark or by thermal shock. Little detail.

*INORG DEMO HITEMP 1

Thermal Decomposition of Water by the Use of the Nernst Glower
Glaser, J. O.
J. Chem. Educ. 46 ,A49 (1969)
Nernst glower is a way to reach 2300 C. A Chem Ed Tested Demonstration.

*INORG CLATH COMPLEX CRYSTAL PREP 2

A Simple Host Lattice Experiment
Graddon, D. P.
J. Chem. Educ. 47 ,711 (1970)
Isothiocyanate complexes with pyridines. Prepn of M(NCS)2.py4, M = Co^{++}, Zn^{++},Cu^{++}. in cocrystallization of Zn^{++} and Cu^{++} compound, the Zn(NCS)2(py)2 traps and stabilizes tetrahedral Cu(NCS)2(py)2.

*INORG ANAL REDOX 1

Vanadium for High School Students
Grant, A. W., Jr.
J. Chem. Educ. 54 ,500 (1977)
Emphasis is on color of lower oxidation states produced by zinc reduction of vanadium(V). Students are to titrate violet V(II) back to yellow V(V) with permanganate, noting colors of V(III) and V(IV).

*INORG APPARATUS HPRESS ORGANOMETAL PREP 4 HAZARD

High Pressure Synthesis of Metal Carbonyls
Hagen, A. P.; Miller, T. S.; Terrell, D. L.; Hutchinson, B.; Hance, R. Daniels, L.;
J. Chem. Educ. 56 ,479 (1979)
Tungsten and molybdenum hexacarbonyls by direct reaction of trioxides with CO at 350 deg. at 1000 atm. Details for microreector given.
HAZARD: Toxicity, high pressure.

*INORG ANAL ACBA COORD DTA MAGNETIC NOPROC PREP PROJ 2

Experiments on Metal Ammine Salts
Haight, G. P., Jr.
J. Chem. Educ. 40 ,468 (1963)
(Cu(NH3)4H2O)SO4 prepared and investigated by a variety of methods: iodimetry (Cu), precipitation (SO4=), thermal decomposition, etc. Extensions to other metal ammine salts.

*INORG DEMO MAGIC 0

Chemistry is Fun, Not Magic
Hanson, R. H.
J. Chem. Educ. 53 ,577 (1976)
Experiments to entertain and illustrate very simple principles for elementary students; mostly taken from other sources, but well-integrated.

*INORG COORD GEOM UVIS 3 HAZARD

Spectral Comparison of Geometric Isomers
Haworth, D. T.; Elsen, K. M.
J. Chem. Educ. 50 ,300 (1973)
Cis and trans isomeric ethylenediamine, oxalate, etc., complexes of Co(III) and Cr(III) prepared, and uvis spectra measured. HAZARD: chromium(VI) starting material is carcinogen.

*INORG ANAL FLUOR QUAL 2

A Fluorescent Indicator for a Confirmatory Test for the Aluminum Ion
Haworth, D. T.; Starshak, R. J.; Surak, J. G.
J. Chem. Educ. 41 ,436 (1964)
PAN(1-(2-pyridylazo)-2-naphthol) gives distinct color and uv-stimulated fluorescence.

*INORG ANAL KSP NONAQ NOPROC PREP SOLUB 2 3

Student Experiments Involving Unknown Solubility Constants
Heinz, D. E.
J. Chem. Educ. 44 ,114 (1967)
Students are provided with either sorbic or cinnamic acid, asked to synthesize, purify and identify one of Ag^{+},Cu^{++}, Pb^{++} or Zn^{++} salt and detn Ksp in a mixed solvent. Almost no detail.

*INORG HISTORIC PROJ 3

Synthesis, Properties and Hydrolysis of SbCl3
Hentz, F. C., Jr.; Long, G. G.
J. Chem. Educ. 52 ,189 (1975)
Reaction of Sb2O3 with HCl followed by distillation gives several products, analyzed by acid -base and by permanganate titn. Specific directions. WARNING: SbCl3 is toxic, evolves HCl on contact with H2O.

*INORG PREP RELOX SEQ TITN 3 HAZARD

Synthesis, Properties, and Hydrolysis of Antimony Trichloride
Hentz, F. C., Jr.; Long, G. G.
J. Chem. Educ. 52 ,189 (1975)
Reaction of Sb2O3 with HCl, followed by distillation. Hydrolysis products are analyzed by acid-base and by KMnO4 titration. Hazards: SbCl3 evolves HCl on contact with water, and is toxic and burns skin. All antimony-containing compounds are somewhat toxic.

*INORG PHYS COORD KIN PREP REDOX UVIS 3 HAZARD

The Preparation and Kinetics of Aquation of Bromopentaaquochromium(III): A new multipurpose experiment
Herman, I. J.; Lifshitz, A.
J. Chem. Educ. 47 ,231 (1970)
CrO3 is reduced (by H2O2) to Cr(II), then oxidized by Br2 to the compound. Rate of hydrolysis at two temp. by uvis. HAZARDS: Cr(VI) is a carcinogen; bromine (burns).

*INORG PHYS REDOX 2

A Copper Mirror: Electroless Plating of Copper
Hill, J. W., Foss, D. L., Scott, L. W.
J. Chem. Educ. 56 ,752 (1979)
Simple experiment for basic techniques and theory in Gen. Chem. Lab. Cu self-plates from tartrate soln onto a prepared glass surface. Technique is critical. Remark: "electroless" means an electrochemical reduction carried out without the use of a current sourc .

*INORG COORD IR ISOMERS KIN PREP PROJ SOLID 3

A Combined Infrared and Kinetic Study of Linkage Isomers: An inorganic experiment
Hohman, W. H.
J. Chem. Educ. 51 ,553 (1974)
Nitro- and nitritopentamminecobalt(III) chloride synthesized (easy). IR (KBr pellet) Kinetics of interconversion in solid state by ir (weeks). Extensions.

*INORG ANAL PHYS COMPLEX IR NOPROC STOICH 4

Determination of Hydration Numbers by Near Infrared: An advanced undergraduate experiment
Hollenberg, J. L.
J. Chem. Educ. 56 ,278 (1979)
An alternative to Kahn and Stephens' method (for abstract, see this document), avoiding the addition of the inert salt. The mthd is based on differential near-IR spectra of the aq. solutions, compared to pure water. Not detailed experimentally, but theory explicit.

*INORG IR MASSPEC PHOTO PREP VACTEK 5

The Photochemical Reaction of Xenon with Fluorine at Room Temperature: A demonstration of the reactivity of xenon
Holloway, J. H.
J. Chem. Educ. 43 ,202 (1966)
Not a class demo. Pure xenon and pure fluorine mixed in evacuated bulb (precautions on dry, pure) in sunlight form crystals of XeF2, examine ir (KBr) and mass spec.

*INORG CHIRAL GEOM ISOMERS POLARIM PREP RESOLUTION 4

The Resolution of a Racemic Compound: An experiment for the inorganic laboratory
House, D. A.
J. Chem. Educ. 53 ,124 (1976)
Resolution of cis-(CoCl(en)2(MeNH2))** using potassium (+)-tartrato-(-2)antimony(III) oxide. The (+) cation is isolated as the tetrachlorozincate by the addition of the less soluble diastereomer. For isolation of the (-) cation, use is made of differences between the racemic and the (-) dithionates.

*INORG IR MAGNETIC ORGANOMETAL PREP PROJ 4 HAZARD

The Design of Integrated Inorganic Experiments: An example from organo-transition element chemistry
Hunt, G. R. A.
J. Chem. Educ. 53 ,53 (1976)
Cyclopentadienyliron dicarbonyl dimer prepared iron pentacarbonyl and dicyclopentadiene, reduced. Det'n magnetic, infrared, pmr(variable temp). Lit., extensions. Ir - detailed discussion. For prep: refer literature. HAZARD: metal carbonyls extremely toxic.

*INORG COORD IR PREP 4 HAZARD

A Non-Hazardous, Bench Top Experiment With an Electron-Deficient Compound
James, B. D.
J. Chem. Educ. 52 ,260 (1975)
Bis(triphenylphosphine)copper(I) tetrahydroborate prepared and ir spectrum discussed, also thermal decomp. Warning: non-vacuum technique - triphenyl phosphine evolved during thermal decomp. HAZARD: benzene, carcinogen.

*INORG COORD PREP 3

The Busy Student's Guide to The Nitration of Tris-Acetylacetonates of Cobalt(III) and Chromium(III)
James, B. D.
J. Chem. Educ. 51 ,568 (1974)
Half of a lab period suffices for copper nitrate-acetic anhydride nitration of metal acetonylacetates, such as cobalt.

*INORG ORGANOMETAL PREP 4 HAZARD

Ferricinium Picrate: Preparation of a ferrocene derivative
Johnson, D. W.; Rayner-Canham, G. W.
J. Chem. Educ. 49 ,211 (1972)
Ferricinium ion is prepared by reacting ferrocene with benzophenone; picric acid ppts the salt. IR, VIS, NMR and MASSPEC parameters discussed. Hazard: picrates (explosive).

*INORG PREP 2

A Convenient Procedure For The Preparation of Potassium Trioxalatoferrate(III)
John[illegible] R. O
J. Chem. Educ. 47 ,702 (1970)
Easy (less than one period) prep'n. No characterization. but suggestions.

*INORG DEMO PREP 2

The Preparation of Various Kind of Glass
Jones, R. F.
J. Chem. Educ. 55 ,450 (1978)
Boron and silicon glasses are prepared using Meeker burner or gas-oxygen hand torch. May be colored with cobalt. A tested demonstration.

*INORG IONX NMR STOICH 4

Determination of Hydration Number by NMR: An advanced undergraduate experiment
Kahn, E. M.; Stephens, J. F.
J. Chem. Educ. 54 ,62 (1977)
Variable temp. probe required. Some standardization by ionx and titn. Addition of Ca(NO3)2 to solutions of Al, Ca, Ga, In salts allows low temp. (-35 deg.C) resolution of protons in hydration shell and rough integration. Caution: watch out for freezing tubes in the probe.

*INORG ACBA PREP STOICH UVIS 2 HAZARD

The Stoichiometry of Silver Chromate and Basic Copper Chromate
Kalbus, L. H.; Petrucci, R. H.
J. Chem. Educ. 46 ,776 (1969)
Silver chromate by continuous variation method (ref.). Copper chromate prep'n given, characterization by acid titration and spectrophotometry at 610 and 440 nm. HAZARD: chromates are carcinogenic.

*INORG ANAL ACBA COORD TITN 3

The Preparation and Analysis of Some Metal-Pyridine Complexes: A general chemistry experiment
Kauffman, G. B.; Albers, R. A.; Harlan, F. L.
J. Chem. Educ. 50 ,70 (1973)
M(II) pyridine-thiocyanate complexes. M(II) is Mn, Fe, Ni, Cu, Zn. Simple analysis. Extensions optional (ref).

*INORG HISTORIC IONX PREP 2

Wohler's Syntheses of Artificial Urea: A modern version of a classic experiment
Kauffman, G. B ; Chooljian, S. H.
J. Chem. Educ. 56 ,197 (1979)
Ammonium cyanate from silver or lead cyanate (Wohler method) or by ion exchange, or metathesis. Formation of urea is confirmed by acid and base reactions, heavy metal salts.

*INORG COORD PREP QUAL REDOX 2 HAZARD

Pseudohalogens: A general chemistry laboratory experiment
Kauffman, G. B.; Foust, G. E.; Tun, P.
J. Chem. Educ. 45 ,141 (1968)
Prep'n of many compounds by test tube reactions, analysis, redox properties. Many reactions. HAZARDS: cyanides, thiocyanogen, cyanogen, bromine and references to other hazardous preparations. Bibliographers suggest too hazardous for gen. chem. students. Moreover, the hazards are not limited to the lab period, but extend to disposal, storage, etc.

*INORG ANAL NOPROC PREP TITN 2

Syntheses and Titrations of Unknown Acids
Kauffman, G. B.; Houghten, R. A., Jr.
J. Chem. Educ. 44 ,408 (1967)
Suggestions for preparation (by ref.) and analysis by acid-base titration of seven inorganic and organic acids.

*INORG CHIRAL COORD GEOM HISTORIC ISOMERS PROOF RESOLUTION 4

A Classic in Coordination Chemistry: A resolution experiment for the inorganic laboratory
Kauffman, G. B.; Lindley, E. V., Jr.
J. Chem. Educ. 51 ,424 (1974)
Follows Werner's proof of octahedral configuration of cis-bromoamminebis-(ethylenediamine)cobalt(III) bromide (prep. ref.). Reaction with ammonium(+)-alpha-bromocamphor-pi-sulfonate gives diastereomers, separable by crystallization. Polarimetry.

*INORG CHIRAL COORD ISOMERS PROJ RESOLUTION 4

Resolving Coordination Compounds by a Second Order Asymmetric Synthesis
Kauffman, G. B.; Sugisaka, N.; Reid, I. K.
J. Chem. Educ. 41 ,461 (1964)
D-Oxalatobis(ethylenediamine)cobalt(III) iodide used to resolve trisoxalatochromate(III) ion. Preparations of both by reference. Extensions to racemization rates. Polarimeter.

*INORG PHYS CHIRAL COORD KIN POLARIM RESOLUTION 4

Resolving Optically Active Coordination Compounds: An experiment for the inorganic laboratory
Kauffman, G. B.; Takahashi, L. T.
J. Chem. Educ. 39 ,481 (1962)
Trisoxalatocobaltate(III), tris(1,10-phenanthroline)nickel(II) resolved with potassium d-antimony tartrate. Cold solutions, rapid work-up, seems not simple. Racemization rates followed.

*INORG COORD TECHNIQUE 3

The Lighter Lanthanides: A laboratory experiment in rare earth chemistry
Kauffman, G. B.; Takahashi, L. T.; Vickery, R. C.
J. Chem. Educ. 40 ,433 (1963)
Fract. crystallization, sep'n and identification of Ce, La, Pr, Nd. Uses Lindsay code 330 rare earth oxide. Simplified procedures, but refs.

*INORG ACBA PREP STOICH 2 HAZARD

Isopoly and Heteropoly Compounds: A general chemistry laboratory experiment
Kauffman, G. B.; Vartanian, P. F.
J. Chem. Educ. 47 ,212 (1970)
Molybdates, phosphomolybdates, tungstocobaltates, etc. prepared. Characterization by titr., conductance (not quant.), redox, precipitation, ionx, etc. Extensions. HAZARD: some preparation use chromates and arsenates - carcinogenic and toxic.

*INORG ORG GC MASSPEC PREP 4 HAZARD

The Preparation of Anhydrous Chromium(III) Chloride and the Pyrolysis of Carbon Tetrachloride.
Keiter, R.; Ahnger, T.; Maurice, A.; Baldwin, T.
J. Chem. Educ. 55 ,52 (1978)
Reports identification of the white solid which may form together with CrCl3 in student prep of this compound from chromium(III) oxide and carbon tetrachloride at 800 deg. as a mixture, principal components hexachloroethane and hexachlorobenzene. Also reports successful classroom use of this identification by mass spec and gas chromatography as a student project. Hazard: carcinogens.

*INORG PHOTO SOLID 2

A Short Experiment in Xerography
Keyzer, H.
J. Chem. Educ. 46 ,530 (1969)
Sulfur layer activated by electrostatic charge (rub with fur), then image of opaque object developed by UV.

*INORG PHYS COORD QUANTUM UVIS 5

D(8) Energy Level Diagram: An experiment for advanced students
Kilner, M.; Smith, J. M.
J. Chem. Educ. 45 ,94 (1968)
Nickel complexes (supplied) used for 300-1000 nm spectrum. Study questions.

*INORG ANAL COORD EDTA PREP TITN 3

Preparation and Properties of a Series of Cobalt(II) Complexes
King, H. C. A.
J. Chem. Educ. 48 ,482 (1971)
Pyridine complexes. EDTA titration.

*INORG ELECTROANAL NOPROC STOICH 2

Experimental Approach to Stoichiometry
King, L. C.; Cooper, M.
J. Chem. Educ. 42 ,464 (1965)
Students given minimal directions, to approach as a research problem - solubility, acid-base tit'n, coordination, mostly using pH meter.

*INORG CRYO KEQ 2

Demonstration of a Reaction in Frozen Aqueous Solutions
Kiovsky, T. E.; Pincock, R. E.
J. Chem. Educ. 43 ,361 (1966)
Equilibrium in the arsenic acid-iodine reaction is affected by concentration (responsive to freezing), gives color change.

*INORG ANAL ACBA HISTORIC PREP TITN 2

The Solvay Synthesis of Sodium Hydrogen Carbonate
Kirksey, H. G.
J. Chem. Educ. 55 ,272 (1978)
Drop dry ice into sodium hydroxide and immediately cap with a large sturdy balloon. Students are not given a procedure, are asked to prepare, and prove they prepared the product. Requires discussion and experimentation. This is for the instructor.

*INORG STOICH 2

The Oxidation Number of Silicon: An introductory experiment
Kirksey, H. G.
J Chem. Educ. 51 ,399 (1974)
Silicon reacted with NaOH, weight loss and volume of hydrogen measured. Caution: hydrogen evolved.

*INORG ORG DEMO ORGANOMETAL PREP 4 HAZARD

Preparation of Ethylaluminum Sequi-Iodide: a lecture demonstration
Krahe, E.; Rochow, E. G.
J. Chem. Educ. 43 ,63 (1966)
From ethyl iodide and aluminum. HAZARDS: violently reactive compounds, toxic compounds; iodine vapor.

*INORG PHYS COMPUTER DRYLAB KIN NMR STEREO STRUCT 4 5

Nuclear Magnetic Resonance Studies of the Stereochemistry and Non-Rigidity of Titanium-Beta-Diketonate Complexes: An interpretative NMR experiment
Kranbuehl, D. E.; Metzger, P. M.; Thompson, D. W.; Fay, K. C.
J. Chem. Educ. 54 ,119 (1977)
Analysis of low temp. proton nmr studies three complexes to predict structure. Computer simulation of nmr. Kinetics and mechanism of ligand rearrangement. Could be all drylab or students could either run nmr (to -50 deg. C) or prepare complexes.

*INORG COORD PREP 2

Student Synthesis of Tris(ethylenediamine)cobalt(III) Chloride
Krause, R. A.; Megargle, E. A.
J. Chem. Educ. 53 ,667 (1976)
Easy one period preparation by a rapid method.

*INORG ANAL AA COORD ELECTROPHOR KEQ 3

Thiocyanatochromium(III) Complexes: Separation by Paper Electrophoresis and Estimation of Stability Constants
Larsen, E.; Eriksen, J.
J. Chem. Educ. 52 ,122 (1973)
Stepwise formation constants for all six Cr(III)-SCN(-)-H2O mononuclear Werner complexes estimated. Needs electrophoresis chamber with water-cooled support. Atomic absorption for improved accuracy.

*INORG ACBA COLOR DEMO REDOX 2

The Precipitation of Ferrous Hydroxide: A Lecture Demonstration
Lau, O. W.
J. Chem. Educ. 56 ,474 (1979)
Shows pale green color of iron (II) hydroxide, then orange of iron (III), and deep blue of the "mixed valence" compound.

*INORG COORD GEOM NMR UVIS 4

Identification of Geometrical Isomers of Cobalt(III)-Iminodiacetate System: An inorganic laboratory experiment.
Lawrence, G. A.; Rix, C. J.
J. Chem. Educ. 56 ,211 (1979)
Two differently colored geometric isomers prep'd by method of Weyh,J.A., J. Chem. Educ., 47, 715 (1970) - see this bibliography. This article concentrates on the analysis and structure, mostly by PMR in D2O.

*INORG PHYS COORD NMR PH STRUCT 4 HAZARD

An NMR Protonation Study of Methyldiethylenetriaminepentaacetic Acid Complexes: An integrated senior chemistry experiment
Letkeman, P.
J. Chem. Educ. 56 ,348 (1979)
Pmr shifts vs. pH used to find protonation sequence in ligand. Similiarly, shifts in Pb-DTPA or Cd-DPTA used to det'n structure. Extensions. Hazard: Pb and Cd compounds.

*INORG COORD DEMO 2 HAZARD

The Reaction of CN- Ions with Ni(EDTA)-- Ions
Littlejohn, D. G.; Fanning, J. C.; Jostansek, E. C.
J. Chem. Educ. 49 ,A26 (1972)
Slow reaction with striking color changes. HAZARD: cyanides.

*INORG ANAL PREP TITN 2

Isopolyvanadates: Synthesis and Characterization
Long, G. G.; Stanfield, R. L.; Hentz, F. C., Jr.
J. Chem. Educ. 56 ,195 (1979)
Easy prep. Analysis for ammonium (Kjeldahl), vanadium (permanganate titr.) and water (P2O5 desiccator).

*INORG DEMO 1

The Reducing Property of Ammonia: A Chem Ed Tested Demonstration
Long, R. H.
J. Chem. Educ. 49 ,A85 (1972)
Black CuO and white (NH4)2CO3 react together to give red Cu/Cu2O and nitrogen mixture with obvious water evolution.

*INORG ANAL COLUMNC NOPROC QUAL 2

Column Chromatographic Analysis of the Metal Ions
Marie, E., Sr.
J. Chem. Educ. 41 ,436 (1964)
General description only; detailed experiment can be purchased.

*INORG CATALYSIS HISTORIC HITEMP PREP 2 3

Synthesis of Sulfuric Acid by the Contact Process: A student laboratory experiment
Martin, J. A.; Baudot, P.; Monal, J. L.; Lejaille, M. F.
J. Chem. Educ. 52 ,188 (1975)
Special apparatus. Vanadium oxide on silica catalyst in gas train tube furnace (500 deg. C). Warning: SO3 bottle; furnace; exothermic rxn.

*INORG GRAVIM STOICH 2 HAZARD

Reduction of Oxides by Hydrogen
Masterton, W. L.; Demo, J. J., Jr.
J. Chem. Educ. 35 ,243 (1958)
Hydrogen is generated in a home-made glass apparatus wherein dilute sulfuric acid is allowed to drop on zinc metal. It passes over a weighed oxide heated with a burner. The spent hydrogen is burnt off at the exit of the tube. HAZARD: explosive potential, with flying glass splinters.

*INORG DEMO PREP REDOX SOLID 1 2

Solid Phase Reduction of Salt Crystals
Mathur, P. B.
J. Chem. Educ. 39 ,A89 (1962)
CuSO4 crystals are covered with solid NaCl, filter paper, iron plate; jar is then filled with sat'd aq. NaCl. 24-hrs standing time converts CuSO4 crystals to pure Cu crystals. Extensions suggested.

*INORG PHYS HITEMP PHASE PREP SOLID STOICH XRAY 4

An Experiment in High Temperature Solid State Chemistry
McCarthy, G. J.
J. Chem. Educ. 49 ,209 (1972)
TiO2-Ti system. Prep'n and x-ray characterization of a non-stoichiometric oxide, TiO (approx. 1), in sealed tubes under vacuum. Additional exp'ts outlined. Caution: the usual high temp., dust and fire prevention precautions when using metallic Ti must be observed.

*INORG PHYS APPARATUS COORD DEMO HEAT 2

A Thermochromic Demon Catcher
McGill, J.
J. Chem. Educ. 48 ,280 (1971)
Note on use of pink-blue color change of Co(II)-Cl- solutions (aq. n-propyl alcohol) as used to illustrate change in complexation with temperature. Simple apparatus for automation for demo purposes. The word "demon" is intended humorously.

*INORG PHYS APPARATUS ELECTROCHEM PREP SOLID 4 5

Electrochemistry in the Solid State
McKechnie, J. S.; Turner, L. D. S.; Vincent, C. A.; Lazzari, M. Scrosati, B.
J. Chem. Educ. 55 ,418 (1978)
Preparation of various solid electolytes, e.g.((CH3)4N)2Ag13I15. Various experiments include pressing into disks (e.g., IR pellet die), measuring conductance, investigating charge carriers, and use in the construction of solid state batteries. Very detailed. Requires audiofrequency AC bridge, voltmeter, constant current source.

*INORG ANAL ORG COMPLEX MACROCYCLE PREP 4 HAZARD

Synthesis and Characterization of a Macrocyclic Nickel Complex; An Experiment to Conclude an Advanced Inorganic or Analytical Course.
Merrell, P. H.; Urbach, F. L.; Arnold, M.
J. Chem. Educ. 54 ,580 (1977)
The complex 5,7,7,12,14,14-hexamethyl-1,4,8,11-tetraazocyclotetradeca-4,11-dieneatonickel (II) iodide is prepared in a two-step synthesis and analyzed for nickel, iodide (one method uses chloroform, HAZARD); chararacterization includes conductivity, spectroscopicmsmnts, nmr, etc.

*INORG HITEMP PHOSPHOR PREP UVIS 3 HAZARD

Simple Preparation of Phosphors
Mikus, F. F
J. Chem Educ 40 ,362 (1963)
Furnace (900 deg. C). SiO_2 crucibles. Strong UV source. ZnS phosphors prepared. Warning high temperature techniques. Furnace should be in hood. HAZARD: $SbCl_3$ is toxic; CdS carcinogenic, avoid.

*INORG TECHNIQUE TITN VACTEK 4

The Tensiometric Titration of Trimethylamine With Boron Trifluoride: An advanced inorganic laboratory experiment
Mills, J. L.; Flukinger, L. C.
J. Chem. Educ. 50 ,636 (1973)
Diagram of a high-vacuum line tensimeter given. Caution; air-sensitive gases.

*INORG CRYSTAL DEMO SOLID 1 2

Detection of Water of Crystallization - Preparation of Oxygen
Mohamed, P. A.
J. Chem. Educ. 38 ,A89 (1961)
Mixtures of Na_2O_2 and hydrated salts, eg. $MgSO_4.7H_2O$, when warmed, evolve oxygen while anhydrous salts and sodium peroxide do not. A Chem-Ed Tested Demo.

*INORG ANAL DISTRIB NOPROC REDOX TITN 3 HAZARD

Inorganic Reaction Mechanisms by Volumetric Analysis: Oxidation of Iodide Ion
Moody, G. J.; Thomas, J. D. R.
J. Chem. Educ. 40 ,151 (1963)
No procedure. Two steps in oxidation of I^- to I^+ by CrO_3 elucidated by separation, titration. I_2 is extracted with CCl_4. HAZARDS: CrO_3, carcinogen; CCl_4, carcinogen (avoidable).

*INORG ANAL DISTRIB IONX PREP TITN 2 HAZARD

Preparation of Reagent-Grade Iron Oxide From Iron Ore: An experiment for freshman chemistry
Mulokozi, A. N.
J. Chem. Educ. 50 ,634 (1973)
Directions are skimpy. Extraction of iron with organic solvent as $FeCl_4^-$ which is then isolated on strong base anion exchange resin. HAZARD: perchloric acid decomposition of minerals, some of which may be sulfides, or contain organic mat'l. Perchloric acid is also a storage hazard. Bibliographers suggest Na_2O_2 fusion instead.

*INORG ANAL COORD INSTR IR PREP PROJ 4

The Characterization of a Coordination Complex Using Infrared Spectroscopy: An inorganic or instrumental experiment
Nathan, L. C.
J. Chem. Educ. 51 ,285 (1974)
Spectra by Nujol mull, KBr pellet, and CH_3CN solution for complexes: KSCN, $K_2Hg(SCN)_4$, $K_2Co(NCS)_4$, $HgCo(SCN)_4$, $Ni(4\text{-}CN(Py))_4(CNS)_2$, internal standard.

*INORG PREP 2 HAZARD

The Preparation of PbI_2 From Galena
Nechamkin, H.; Dumas, P.
J. Chem. Educ. 55 ,681 (1978)
Complete easy procedure with study questions. HAZARD: H_2S evolved from $PbS + 2HCl$. Must be done with alkali trap to catch H_2S, and in hood. This is NOT STATED.

*INORG CONSUMERPROD ENVIRON PREP 2

The Recovery of Silver from Film
Nechamkin, H.; Dumas, P. E.
J. Chem. Educ. 53 ,370 (1976)
Silver recovered by ashing film, dissolving in nitric acid. Ag collected by self-deposition on Cu wire. Caution: some sources say films may explode while ashing.

*INORG PHYS ASSOC KEQ SOLUB 2 HAZARD

Investigation of Interaction in the $Pb(NO_3)_2$-NaCl-Methanol-Water System
Neidig, H. A.; Yingling, R. T.
J. Chem. Educ. 42 ,475 (1965)
Solubility measured; $Pb(Cl)_2$ solid in equilib.; Pb ion in solution, Cl- ion in solution. Student reasoning about change in solubility with changes in methanol-water ratio. HAZARD: asbestos in Gooch filter; use alternative filtration method.

*INORG CATALYSIS DEMO 2

Continuous Process for Catalytic Oxidation of Ammonia
Olmsted, M. P.
J. Chem. Educ. 41 ,A97 (1964)
Ammonia by aspirating air thru solution, platinum wire. A Chem Ed Tested Demo.

*INORG COORD PREP 2

Synthesis and Reactions of Cobalt Complexes
Olson, G. L.
J. Chem. Educ. 46 ,508 (1969)
Cobalt(III)/NH3. Easy preparations of several complexes. No characterization.

*INORG DEMO STOICH 2 HAZARD

Reaction Stoichiometry and Theoretical Yield
Ondrus, M. G.
J. Chem. Educ. 53 ,228 (1976)
Ammonium dichromate volcano - weigh before and after; calc. yield. Very spectacular.
HAZARD: Chromium(VI) is carcinogenic; dust is emitted. Perform only in hood.
A tested demonstration.

*INORG GAS PREP 2

Nitrogen Oxides Experiments
Ophardt, C. E.
J. Chem. Educ. 53 ,374 (1976)
NO and NO2 generated and properties qual. demonstrated.

*INORG ANAL GLOVEB IR PREP QUANTUM UVIS 4

Preparation and Structural Characterization of Ammonium Hexaquovanadium(II) Sulfate: An advanced inorganic chemistry experiment
Patel, K. C.; Goldberg, D. E.
J. Chem. Educ. 50 ,868 (1973)
Uvis spectrometer with reflectance attachment. Glovebox or N2 purge.
Grav. anal. for sulfate. Ir spectra analyzed; group theory.

*INORG COORD IR PREP UVIS 2

The Preparation and Investigation of Bis(acetylacenato) Copper(II)
Peacock, R. D.
J. Chem. Educ. 48 ,133 (1971)
Simple preparation. Questions. Little characterization.

*INORG COORD DEMO MAGNETIC 2

Paramagnetism
Peng, Y-T.
J. Chem. Educ. 40 ,A40 (1963)
(Fe4Fe(CN)6) complex diffuses toward magnetic field, or from it at a boundary between Fe(III) solution and K4Fe(CN)6 solution. A Chem Ed Tested Demo.

*INORG GRAVIM SOLID STOICH 2

A Demonstration in Solid State Chemistry: The Non-Stoichiometry of Nickel Oxide, NiO.
Perrino, C. T.; Johnson, R.
J. Chem. Educ. 54 ,367 (1977)
A grey nickel oxide Ni(0.98)O obtainable from Baker Chem Co can be converted to the stoichiometric green NiO by heating. Oxygen is evolved.
Stoichiometry can be calculated from weight data. A Chem. Ed. Compact.

*INORG DEMO REDOX 1

Oxidation and Reduction of Iron
Poppel, S. M.; Abrahams, H. J.
J. Chem. Educ. 36 ,A17 (1959)
Chem-Ed Tested Demo. Simple inorganic reactions.

*INORG COORD PREP 3 HAZARD

The Preparation of Potassium Hexacyanocobaltate(III)
Poskozim, P. S.
J. Chem. Educ. 46 ,384 (1969)
Easy prep. by two routes (one in inert atmosphere). HAZARD: cyanides should be avoided, even though used here in alkaline sol'n.

*INORG COORD PREP UVIS 2

Synthesis and Spectral Study of Copper(II) Complexes
Potts, R. A.
J. Chem. Educ. 51 ,539 (1974)
Glycine, acetylacetone complexes and their visible spectra.

*INORG IONX SEPARATION 1

The Separation of Rare Earths: A project for high school chemistry students
Powell, J. E.; Spedding, F. H.; James, D. B.
J. Chem. Educ. 37 ,629 (1960)
Detailed instructions for construction of an ion-exchange column using equipment commonly available in high school laboratories. Polystyrene-divinylbenzene cation exchanger; sample is loaded as the chloride, eluted with HEDTA (hydroxy-ethyl-EDTA). The chloride solution is prepared from monazite rare-earth mixtures. All details given.

*INORG CONSUMERPROD PH PREP 1

Making Baking Powder Biscuits
Rainey, R. G.
J. Chem. Educ. 39 ,363 (1962)
Class makes monocalcium phosphate - baking soda with pH control (indicator) by varying ratio, testing at home to see how biscuits turn out.

*INORG ANAL PHYS KEQ PH TITN 2

The Interaction of Chromium(III) Ion with Hydroxide Ion - an experiment for the undergraduate inorganic laboratory
Reinhardt, R. A.
J. Chem. Educ. 43 ,382 (1966)
Estimation of turbidity, eyedropper titration. Calculation of Ka, Ksp, etc.

*INORG IONX PREP 2

A Simple and Impressive Laboratory Exercise in Ion-Exchange
Renganathan, S.; Mehta, B. J.
J. Chem. Educ 53 ,347 (1976)
A lab exercise to recover silver from AgCl precipitates as mixed silver and ammonium nitrates. Uses a cation exchange resin.

*INORG IR PREP 4 HAZARD

Infrared Spectroscopy of Tetrahedral Ligands: An advanced experiment in inorganic chemistry
Ribas, J.; Casabo, J.; Coronas, J. M.
J. Chem. Educ. 54 ,321 (1977)
Easy preparation and IR spectra of (CrCrO4(NH3)5)X, where X = nitrate or perchlorate. The point of the experiment is to study the changes in the $CrO_4^{=}$ ion with ionic environment. HAZARD: chromates (respiratory, carcinogen); perchlorates (storage).

*INORG DEMO EXPLOSION KIN MAGIC 1 HAZARD

Decomposition of a Metallic Picrate
Rose, D. E
J. Chem. Educ. 35 ,A2E (1958)
Picric acid + PbO (litharge). HAZARD: EXTREME EXPLOSIVE HAZARD. The alternative method described is a hazard to the eye. The mixing method described may cause a serious explosion. This exercise was intended as a demo for h.s. students. It is far too hazardous for them; people have been killed when mixing lead salts with picrates.

*INORG ACBA BIOCHEM COMPUTER COORD PH TITN 3

Determination of the Stability Constants of Nickel(II)-Cysteine
Rose, T. L.; Seyse, R. J.
J. Chem. Educ. 53 ,728 (1976)
Weighed samples of L-cysteine titd with std. NaOH in presence and absence of Ni^{++} ion. Computer analysis of data gives formation constants for two complexes.

*INORG APPARATUS DEMO MAGNETIC QUANTUM 2

A Simple Demonstration of O2 paramagnetism: A Macroscopically Observable Difference Between VB and MO Approaches to Bonding Theory
Saban, G. H.; Moran, T. F.
J. Chem. Educ. 50 ,217 (1973)
Apparatus described which allows a stream of droplets of liq. O2 to pass between the poles of a permanent magnet. O2 droplets are deflected, liq. N2 droplets are not.

*INORG DEMO EXPLOSION 2 HAZARD

Silver Acetylides
Sands, F. H.
J. Chem. Educ. 35 ,A38 (1958)
A Chem-Ed Tested Demo. HAZARD: explosive product, glass (home-made) equipment.

*INORG DEMO REDOX 2 HAZARD

Oxidation of PbO
Saurer, J. M.
J. Chem. Educ. 36 ,A61 (1959)
A Chem-Ed Tested Demo. In part a of the demo KClO3 is heated in a test tube with yellow PbO until "blackening"; Pb3O4 forms on cooling. The Pb3O4 can then be further oxidized (part b) with conc. HNO3 to PbO2. HAZARD: Pb-ClO3 mixtures can detonate.

*INORG DEMO PREP 1

Synthesis of Copper(I) Sulfide
Scheer, R.
J. Chem. Educ. 36 ,A17 (1959)
Chem-Ed Tested Demo. Reaction of copper foil with a solution of sulfur in carbon disulfide yields Cu2S. Caution: keep CS2 away from flames.

*INORG DEMO EXPLOSION REDOX 2 HAZARD

Oxidation by Potassium Permanganate
Scheer, R.
J. Chem. Educ. 36 ,A21 (1959)
A Chem-Ed Tested Demo. KMnO4/sugar/glycerine. HAZARD: explosive hazard. Emphatically not for a student experiment; included here to emphasize this.

*INORG CATALYSIS DEMO PREP 2

Synthesis of Copper (II) Sulfide
Scheer, R.
J. Chem. Educ. 39 ,A75 (1962)
Copper sulfate solution provides a catalyst for the reaction of sulfur with copper powder. A Chem Ed Tested Demo.

*INORG ANAL REDOX TITN 3

The Use of Inorganic Redox Mechanisms in Analytical Chemistry
Schenk, G. H.
J. Chem. Educ. 41 ,32 (1964)
Experimental study of As(III)-I2 reaction leads to hypotheses about mechanism, and extensions (mostly citing lit.) to irreversible redox reactions. Some extensions possible.

*INORG ANAL ACBA ELECTRODE HITEMP MOLTENSALT TITN 5 HAZARD

Lewis Acid-Base Titration in Fused Salts
Schlegel, J. M.
J. Chem. Educ. 43 ,362 (1966)
Construction of electrodes. The titration by addition of sodium carbonate to sodium-potassium nitrate fused bath containing a Lewis acid, dichromate ion, using oxygen bubbler. HAZARD: strongly oxidizing melt; dichromate is a carcinogen. This expt was developed for freshmen, but would be unsafe with anything but very small advanced classes.

*INORG HISTORIC PREP 2

Experiments in Alchemy, Part I. Ancient Arts
Schwartz, A. T.; Kauffman, G. B.
J. Chem. Educ. 53 ,136 (1976)
Simple preparations, reductions of metal oxides, preparations of alloys, paints, lime, soap. Excellent text. Instructions are precise.

*INORG HISTORIC MAGIC PREP 2

Experiments in Alchemy II. Medieval Discoveries and Transmutations
Schwartz, A. T.; Kauffman, G. B.
J. Chem. Educ. 53 ,235 (1976)
See part I (this volume, p.136). Continues with acids, bases, "transmutations" and other nice things. Warning: some explosives in this experiment.

*INORG PREP SEQ 2

The Chemistry of Silver: A demonstration sequence
Schwenck, J. R.
J. Chem. Educ. 36 ,45 (1959)
Minimal directions. Flow chart.

*INORG ORG PHYS ESR FREERAD MISTAKE NOPROC 4

Two ESR Systems for the Advanced Undergraduate Laboratory
Serianz, A.; Shelton, J. R.; Urbach, F. L.; Dunbar, R. C.
Kopczewski, R. F.
J. Chem. Educ. 53 ,394 (1976)
N,N-dibenzyl nitroxide radical; and bis-(acetylacetonato)oxyvanadium(IV). Preparation by reference. Outline of experiment used in teaching room temp. ESR. Part of the title seems to be missing (?) from the article.

*INORG PHYS DEMO KIN LUMIN Q'JANTUM 3 4 HAZARD

Singlet Oxygen in Aqueous Solution: A Lecture Demonstration
Shakashiri, B. Z.; Williams, L. G.
J. Chem. Educ. 53 ,356 (1976)
Lecture-scale production of red glow of excited gaseous oxygen by (1) bubbling Cl2 into 30% H2O2 (caution: froths) and (2) from halogen/CCl4/H2O2 reaction. Sketch of (simple) apparatus. Detailed description and molecular orbital description of the phenomenon. A tested demonstration. Emphasis on large lecture; can do a simpler version for a small group or closed-circuit TV. HAZARDS: halogens (toxic), CCl4 (carcinogen), etc.

*INORG ELECTROCHEM HITEMP PHOTO PREP SOLID 3 HAZARD

Experiments with Photoconductive Cadmium Sulfide
Sheehan, W. F.
J. Chem. Educ. 39 ,540 (1962)
Prep. sulfide from thioacetamide and CdCl2, doped with CuS. Porcelain plate fired to 600 deg. C, 500V DC source, conductive silver paint. HAZARDS: CdS, thioacetamide - carcinogens; high voltage hazard.

*INORG CLOCK DEMO KIN MAGIC 0

A Few Chemical Magic Tricks Based on the Clock Reaction
Shigematsu, E.
J. Chem. Educ. 56 ,184 (1979)
Variations on the KIO3-NaHSO3 clock. Explicit. Straightforward.

*INORG COORD KEQ 1

Coordination Complexes and Equilibrium
Shombert, D. J.
J. Chem. Educ. 47 ,781 (1970)
Reaction of Cu^{++}/iron(nails) in presence and absence of excess NH3.

*INORG PHYS CORROSION DEMO REDOX 2

Corrosion: Proceedings of the California Association of Chemistry Teachers
Slabaugh, W. H.
J. Chem. Educ. 51 ,218 (1974)
Some simple tests on corrosion inhibition, including iron, steel and aluminum. Passive iron and steel, cathodic protection, inhibitors, stress. Caution: ball bearings may rupture explosively.

*INORG ANAL CALORIMETRY COMPLEX GRAVIM PREP STOICH 2

The Preparation and Analysis of Some Double Salts: An introductory experiment
Snavely, F. A.; Yoder, C. H.
J. Chem. Educ. 48 ,621 (1971)
M(I)2SO4-M(II)SO4.nH2O crystals where M(I) is K or ammonium, M(II) is Cu, Ni, Co, Zn, prepared and analyzed. Drying to constant weight, gravimetric, calorimetric methods outlined only. Extensions.

*INORG PREP VACTEK 4 5 HAZARD

The Preparation of Aminoboranes: Two high vacuum experiments for the inorganic chemistry laboratory
Spielman, J. R.
J. Chem. Educ. 47 ,225 (1970)
Diborane prep. by reference. Warning: diborane, hydrogen evolved, extremely hazardous for uninstructed persons. These instructions are not detailed.

*INORG GLOVEB ORGANOMETAL PREP 4 HAZARD

The Nitrogen Glove: A technique for handling air-sensitive compounds
Srinivasan, S. C.; Wiles, D. R.
J. Chem. Educ. 48 ,348 (1971)
Devised for studying organometallic compounds on very small scale. Preparation of manganocene and methylmanganese carbonyls. Characterized by gc. HAZARD: metal carbonyl toxicity.

*INORG REDOX TITN 2

The Oxidation States of Molybdenum
Stark, J. G.
J. Chem. Educ. 46 ,505 (1969)
Reduction of Mo(VI) to Mo(V) by Hg and to Mo(III) by Zn(Hg) measured by cerium(IV) titration. Caution: Hg toxicity.

*INORG HITEMP PREP 3

Procedure for Recovering Elemental Silver from Silver Residues
Steed, S. P.; Hayes, J. M.
J. Chem. Educ. 49 ,156 (1972)
By a metallurgical technique. Silver is smelted from AgCl, etc., residues.

*INORG COORD GLOVEB PREP 3 HAZARD

The Synthesis and Characterization of Tin Complexes Using Inert Atmosphere Techniques: An advanced laboratory experiment
Thompson, D. W.; Kranbuehl, D. E.; Schiavelli, M. D.
J. Chem. Educ. 49 ,569 (1972)
SnCl4-acetylacetone adduct, cis-dichlorobis(acetylacetonato)Sn(IV) prepared. Dry box or glove bag. Ir, nmr, etc. suggested. HAZARD: benzene is carcinogen; substitute another solvent.

*INORG ANAL REDOX STOICH TITN 2

Some Experiments on the Stoichiometry of Reactions
Tietze, H. R.
J. Chem. Educ. 48 ,344 (1963)
Five different reactions using ordinary lab reagents.

*INORG DEMO LUMIN PHOSPHOR PREP 2 HAZARD

Luminescent Compounds, ie. Phosphors
Tietzie, H. R.
J. Chem. Educ. 40 ,A49 (1963)
Strontium sulfide and cadmium chlorophosphate phosphors. Requires 800-1000 deg. C. HAZARD: cadmium compounds are carcinogens. A Chem Ed Tested Demo.

*INORG ORG APPARATUS HITEMP ORGANOMETAL PREP VACTEK 5 HAZARD

Transition Metal Vapors in Chemical Synthesis: The direct preparation of dibenzene chromium as an undergraduate experiment
Timms, P. L.
J. Chem. Educ. 49 ,782 (1972)
Chromium is sublimed at 1500 deg. C under high vacuum and the vapor condensed together with benzene vapor on a liq. N2-cooled surface. Diagram of chamber given. HAZARD: benzene, but handled on vac. line.

*INORG PHYS COORD QUANTUM 3

Crystal Field Spectra of Transition Metal Ions: A physical chemistry experiment
Trapp, C.; Johnson, R.
J. Chem. Educ. 44 ,527 (1967)
Max. in absorption over 340-950 nm. by solutions of various transition metal salts plotted using a Bausch and Lomb Spectronic 20. Positions of maxima used to calc. crystal field stabilization energy.

*INORG DEMO PREP 1

Polymorphic Forms of Mercuric Iodide
VanCamp, C. O.
J. Chem. Educ. 37 ,A27 (1960)
Conversion of red mercuric oxide to yellow mercuric oxide by heating. A Chem-Ed Tested Demo.

*INORG PHYS EXCHANGE IONX KIN NMR STOICH 4 HAZARD

A Room-Temperature Proton Magnetic Resonance Hydration Number Study
Vidulich, G. A.; Fratiello, A.
J. Chem. Educ. 55 ,672 (1978)
Dil. sol'ns of aluminum perchlorate nonahydrate in deuterated acetone have slow exchange rates. Hydration number by integration, conc. by titration after cation exchange. HAZARD: perchlorates - storage hazard.

*INORG CATALYSIS DEMO PROJ REDOX 2

Catalytic Oxidation of Manganese (II) Sulfate
Villarreal, F. G.
J. Chem. Educ. 39 ,A55 (1962)
Silver ion catalyzes reaction with persulfate. Mechanism only by "probably". Possible project: effect of other ions, pH? A Chem Ed Tested Demo.

*INORG DEMO PREP REDOX 2

Displacement Reactions - Spongy Tin
Villarreal, F.; Garcia, O.
J. Chem. Educ. 38 ,A63 (1961)
Reduction of SnCl2 solution with granular zinc.

*INORG DEMO MAGNETIC 2

Paramagnetic Properties of Fe(II) and Fe(III)
Walker, N.
J. Chem. Educ. 54 ,431 (1977)
Suspend test tubes, approx. 1/4th full of powdered iron(III) sulfate, iron(II) sulfate, K3Fe(CN)6 and K4Fe(CN)6, with light weight twine. Bring up a small strong magnet, such as Edmund's #70572. A tested demonstration.

*INORG QUANTUM 2

General Chemistry Exercise Using Atomic and Molecular Orbital Models
Walker, R. A.
J. Chem. Educ. 42 ,672 (1965)
Styrofoam balls, pipe cleaners, paint used to make atomic, orbital, and molecular models.

*INORG COORD MAGNETIC PREP PROJ UVIS 4 HAZARD

Magnetic and Spectral Behavior of Co(py)2X2 Complexes
Webb, D. L.; Meek, T. L.
J. Chem. Educ. 55 ,408 (1978)
X = I-, Br-, Cl-, SCN-, N3-, CN-. Minimal directions. Electronic and reflectance spectra, mag. moments given. HAZARDS: cyanides and azides are toxic; chloroform is a carcinogen.

*INORG COORD GEOM IONX PREP 2 3

Preparative and Ion Exchange Studies on the Cobalt(III)-Iminodiacetate System : A laboratory experiment
Wehy, J. A.
J. Chem. Educ. 47 ,715 (1970)
Iminodiacetate is a tridentate ligand. However, three isomers of Co(III) are possible, cis, trans(facial) and trans(meridianal). Explicit directions for prepn of two of these isomers and ion-exchange separation of isomer mixture.

*INORG ANAL GRAVIM STOICH 2

The Law of Definite Proportions: An experiment for introductory chemistry
Wilhelm, D. L.
J. Chem Educ. 50 ,436 (1973)
Exposure of copper foil to iodine vapor yields tough white coating of CuI. This can be dissolved by thiosulfate solution. Weigh foil before and after iodine reaction, again after removing compound, drying w. acetone. Caution: iodine vapors (toxic), acetone (fire)

*INORG ANAL COORD PREP PROJ UVIS 2

A Research Approach in the Introductory Laboratory
Wilson, L. P.
J. Chem. Educ. 46 ,447 (1969)
Prep'n of four or more Co(III) complexes with NH3, ethylenediamine, chloride. Colorimetric analysis for cobalt.

*INORG APPARATUS EXCHANGE NOPROC PREP PROJ TECHNIQUE

A Comparison of Ionic and Covalent Dihalides: An integrated experiment
Woolf, A. A.
J. Chem. Educ. 55 ,738 (1978)
Small scale prep. and exchange reactions of potasdsium dibromoiodate and phenyl iodine dichloride. Anal. by qual. tersts, titn., gc. CAUTION: bromine

*INORG DEMO FLUOR LASER OPTICAL PREP 2

Preparation of a Fluorescent Rare Earth Complex
Workman, M. O.
J. Chem. Educ. 48 ,303 (1971)
Procedure for prep'n of Eu(III)-dibenzoylmethane-piperidine complex (a laser material) for use in demonstration.

*INORG ASSOC NMR PREP SEPARATION 4 HAZARD

The Two Forms of Aluminum Isopropoxide: An NMR experiment
Worrall, I. J.
J. Chem. Educ. 49 ,510 (1969)
Tetramer and trimer preparations (vac. distillation, heating in sealed tube), structure by nmr. HAZARD: benzene, solvent, use a substitute.

*INORG GC PHOTO PREP QUAL TITN 4 HAZARD

A Comparison of Ionic and Covalent Iodine Dihalides: An integrated experiment
Woulf, A. H.
J. Chem. Educ. 55 ,738 (1978)
Prep. of potassium dibromoiodate and phenyl iodine dichloride; thermal and photo reactions of latter. Minimal experimental and analytical directions. Much discussion. Selective tests for halide ions in the mixture given. Special easily-blown reaction tube. Characterization by GC, vol. anal., etc. HAZARD: CHCl3 - carcinogen.

*INORG PHYS ACBA KEQ KIN 4 HAZARD

Hydrolysis of Group IV Chlorides
Yoder, C. H.
J. Chem. Educ. 46 ,382 (1969)
Det'n and comparision of extents and rates of hydrolysis of trimethylchlorosilane and trimethylchloromethane (ie., tert-butyl chloride). Techniques used: titration, distillation, refr. index, density. HAZARD: TMS is corrosive, toxic, flammable, and causes serious burns.

*INORG REDOX STOICH 1 HAZARD

The Reduction of CuO with Burner Gas Without a Fume Hood: A high school chemistry experiment
Zidick, C.; Weismann, T.
J. Chem. Educ. 50 ,717 (1973)
Copper oxide reduction with methane, formula by weight change. Hazard: As described, the experiment involves an explosive hazard. Reader (DT) comments that he has done the expt using carbon dioxide instead of methane with satisfactory results.

*ORG FREERAD GC 3

Free Radical Chlorination
Adduci, J. M.; Dayton, J. H.; Eaton, D. C.
J. Chem. Educ. 48 ,313 (1971)
Reaction of 2,4-dimethylpentane with sulfuryl chloride or N-chlorosuccinimide to demonstrate free radical reactions and relative reactivity of primary, secondary, tertiary H.

*ORG FRIEDEL.CRAFTS PREP 3 4

The Friedel-Crafts Pathway to Diarylcyclopropenones: An Undergraduate Organic Experiment
Agranat, I.; Tapuhi, Y.
J. Chem. Educ. 53 ,531 (1976)
Prepn. and spectral properties of di-2,4-xylylcyclopropenone from tetrachlorocyclopropene. Some discussion of aromaticity.

*ORG HETEROCYCLIC PREP 3 HAZARD

Preparation of 2-Arylimidazo-(2,1-b)Benzothiazoles
Alper, H.
J. Chem. Educ. 47 ,223 (1970)
Students are given the method of prep'n of 2-phenylimidoazo-(2,1b) benzothiazole (from 2-aminobenzothiazole and 2-bromoacetophenone) and asked to prepare it or p- substituted derivative (given the appropriate subtituted acetophenone). 2 periods. HAZARD: 2-bromoacetophenone is a persistent lachrymator. Reader suggests 2-bromoacetophenone is a confusing name: use omega-.

*ORG IR NMR PREP TAUTOMERS 3 HAZARD

Ring-Chain Tautomerism: An experiment in organic chemistry
Alper, H.; Alper, A. E.; Taurins, A.
J. Chem. Educ. 47 ,222 (1970)
2-benzimidazolinethione (2-mercaptobenzimidazole) and chloroacetone are condensed. Tautomeric equilibrium studied, ir, nmr. Two periods. Extension suggested. HAZARD: chloroacetone is a lachrymator.

*ORG ADDITION DEMO NATPROD PREP 1

The Bromination of Acrolein
Alyea, H. N.
J. Chem. Educ. 37 ,A49 (1960)
Bromine vapor is decolorized by a freshly-cooked strip of bacon.
A Chem-Ed Tested Demo.

*ORG NAME NMR PREP SEQ 3

A Crossed Aldol Condensation for the Undergraduate Laboratory
Angres, I.; Ziegler, H. E.
J. Chem. Educ. 51 ,64 (1974)
Two-step sequence: (1) fluorene carbanion reacts with benzaldehyde in benzyl alcohol solution yielding 9-benzalfluorene, (2) reduction to 9-benzylfluorene by refluxing w. KOH/benzyl alcohol at 205 deg. C. Identification parameters and alternate 1-step procedure.

*ORG INORG POLYMER PREP 3

The Preparation of "Bouncing Putty": An undergraduate experiment in silicone chemistry
Armitage, D. A.; Hughes, M. N.; Sinden, A. W.
J. Chem. Educ. 50 ,434 (1973)
Explicit directions. Starting material is dimethylsilicon dichloride.

*ORG IR ISOMERS NMR PREP PROJ PROOF 3 HAZARD

Structural Determinations in Organic Chemistry: Synthesis of Isomeric Allylic Alcohols
Arnaud, C.
J. Chem. Educ. 51 ,819 (1974)
Isophorone reactions; products studied by nmr, ir. Extended project. HAZARDS: LiAlH4, chromic acid, 98% hydrazine.

*ORG PREP 2 HAZARD

Simple Method For The Preparation of 2,4-Dinitroanilina
Ashton, A. A.
J. Chem. Educ. 40 ,545 (1963)
2,4-Dinitrochlorobenzene and aq. NH3. Reaction is simple, but Reader (DT) points out that 2,4-DCB is a bad actor - causes a nasty skin rash. It has been taken out of many labs.

*ORG CHIRAL ISOMERS POLARIM RESOLUTION 2 3

Resolution of D,L-Alpha-Phenylethylamine
Ault, A.
J. Chem. Educ. 42 ,269 (1965)
Fractional crystallization of D-tartrates.

*ORG GC PREP SEQ 3 HAZARD

A Three-Step Synthesis: 2,4-Dinitrophenylhydrazine From Benzene
Ault, A.
J. Chem. Educ. 42 ,267 (1965)
Reaction sequence, standard methods. HAZARD: benzene, bromine.

*ORG CLATH PREP REARRANGE 3 HAZARD

Preparation of Adamantane
Ault, A.; Kopet, R.
J. Chem. Educ. 46 ,612 (1969)
Adamantane from tricyclo(5.2.1.0-2.6)decane (inexpensive). Thiourea inclusion complex. HAZARD: thiourea is a carcinogen.

*ORG PREP TCHROM 3 HAZARD

Two Thermochromic Compounds: Preparations for the introductory organic laboratory
Ault, A.; Kopet, R.; Serianz, A.
J. Chem. Educ. 48 ,410 (1971)
Xanthone, xanthene, anthrone and 9-bromoanthrone (prep'ns by reference) required. Thermochromism (no discussion) shown on melting solids or during recrystallization from mesitylene. HAZARD: bromine

*ORG PHOTO PREP TAUTOMERS 3 HAZARD

A Photochromic Compound: A Preparation for the Introductory Organic Laboratory
Ault, A.; Kouba, C.
J. Chem. Educ. 51 ,395 (1974)
Prepn of 2-(2,4-dinitrobenzyl)pyridine by nitration of 2-benzylpyridine. Crystals turn reversibly deep blue in sunlight. Explicit directions. HAZARD: fuming nitric acid.

*ORG PREP SEQ 3 HAZARD

1-Bromo-3-Chloro-5-Iodobenzene: An Eight-Step Synthesis From Benzene
Ault, A.; Kraig, R.
J. Chem. Educ. 43 ,213 (1966)
React sequence, 6 periods. HAZARDS: benzene, chlorine, iodine monochloride.

*ORG CATALYSIS PREP 4 HAZARD

A New Synthesis of Tertiary Alkyl N-Arylcarbamates From Isocyanates
Bailey, W. J.; Griffith, J. R.
J. Chem. Educ. 55 ,809 (1978)
New procedure for preparation of derivatives for identification of tertiary alcohols from phenyl(naphthyl) isocyanates. Alkoxide catalyst. Not really a student experiment. HAZARD: Li metal.

*ORG ISOMERS POLARIM STEREO 3 4

Determination of The Relative and Absolute Configurations of (-) Menthol and (+) Neomenthol: An introductory stereochemistry experiment
Barry, J.
J. Chem. Educ. 50 ,292 (1973)
Menthone reactions give inference about stereochemistry. Do not let students read article before doing experiment.

*ORG PHYS COMPUTER FREERAD GC KIN VACTEK 4

A Student Experiment For Measuring Rate Constants of Radical Recombination
Bartle, K. D.; Butcher, P. G.; Harding, O. J.; Roberts, B. R.
J. Chem. Educ. 55 ,742 (1978)
Radical buffer method. Di-tert-butyl peroxide, iodoalkanes. Complicated kinetics, simplifying assumptions permit recombination rate constants. Analysis of products by quantitative GC requires computer program (available).

*ORG SOLUB TECHNIQUE 3

Solvent Selection For Recrystallization: An undergraduate organic experiment
Baumann, J. B.
J. Chem. Educ. 56 ,64 (1979)
Elementary technique for solvent selection for unknown. Examples.

*ORG NOPROC PREP SUBST.RXN 3

Directive Effects in Electrophilic Aromatic Substitution: An organic chemistry experiment
Beishline, R. R.
J. Chem. Educ. 49 ,128 (1972)
A "proof-of-structure" experiment is described. Bromination of acetanilide in glacial HOAc.

*ORG ISOMERS NMR PREP PROOF 3

Structure Elucidation: An organic chemistry experiment
Benson, B. W.; Olsen, E. S.; Smeltz, L. A.
J. Chem. Educ. 47 ,220 (1970)
Prep'n. of two isomeric products from methone (5,5-dimethyl-1,3-cyclohexanedione) and salicylaldehyde. Nmr structure det'n.

*ORG PHYS NMR PROJ RADIOCHEM TRACER 4

Carbon-13 NMR Spectra of Styrene Derivatives: An undergraduate experiment involving the application of the Hammett equation
Blunt, J. W.; Happer, D. A. R.
J. Chem. Educ. 56 ,56 (1979)
NMR of series of substituted styrenes determined as class project and analyzed.

*ORG CHIRAL IONX ISOMERS POLARIM PREP RESOLUTION 3 HAZARD

The Resolution of D,L-Histidine: An organic chemistry experiment using an ion exchange resin
Bosch, A. J.
J. Chem. Educ. 46 ,691 (1969)
D-tartaric acid salts of racemic amines eluted. Weak base ion exchange column. HAZARD: liq. Br2 used to test for histidine.

*ORG GC GEOM IR ISOMERS NMR PHOTO PREP TLC UVIS 3

Z- and E- Stereoisomerism: An experiment using photochemistry
Bourelle-Wargnier, F.; Feigenbaum, A.; Muzart, J.
J. Chem. Educ. 55 ,339 (1978)
Prep'n 2-benzylidenecyclohexanone and the photo-rearrangement to the Z-isomer. Differentiate by gc, tlc, nmr, ir, uv. Also behavior of these to epoxidation (Z- much slower).

*ORG COLUMNC ORGANOMETAL PREP 3 HAZARD

Acetylation of Ferrocene: A chromatography experiment for elementary organic laboratory
Bozak, R. E.
J. Chem. Educ. 43 ,73 (1966)
Acetylation with acetic anhydride-phosphoric acid. Chromatography with alumina using benzene as eluant gives ferrocene and acetylferrocene
Used at RPI and extended to dry column chromatog., and also to forcing conditions to diacetylferrocene, and tlc. HAZARD (avoidable): benzene.

*ORG ADDITION CATALYSIS DIEL' .ALDER PHOTO PREP 3 HAZARD

The Photoaddition of Maleic Anhydride to Benzene: A simple organic experiment in a complicated system
Bozak, R. E.; Alvarez, V. E.
J. Chem. Educ. 47 ,589 (1970)
Diels-Alder addition sensitized by benzophenone. Sunlight.
HAZARDS: benzene is carcinogenic; maleic anhydride toxic.

*ORG PHYS CATALYSIS LUMIN PHOTO 2 HAZARD

A Chemiluminescence Demonstration - Oxalyl Chloride Oxidation
Bramwell, F. B.; Goodman, S.; Chandross, E. A.; Kaplan, M.
J. Chem. Educ. 56 ,111 (1979)
Oxidation by alumina - 3% H2O2 slurry. Color depends on sensitizer.
4 candidates given. Explicit details.
HAZARD: Oxalyl chloride is toxic, a lachrymator and irritant, and reacts violently with water.

*ORG NAME PHOTO PHOTORES PREP REARRANGE UVIS 4 HAZARD

A Positive Photoresist: The Photochemical Wolff Rearrangement
Bramwell, F. B.; Zhdjura, R. E.; Paley, C.; Fahrenholtz, S. R.
J. Chem. Educ. 55 ,403 (1978)
Starting material salt of 1-diazo-1,2-naphthoquinone-5-sulfonate. Ethyl ester (prep'n) mixed with resin, exposed uv. HAZARD: chlorosulfonic acid is corrosive and reacts violently with water.

*ORG NAME NAME PREP 3 HAZARD

p-Carboxystyrene: A Wittig Procedure in Aqueous Medium
Broos, R.; Thyernier, D.; Anteonis, M.
J. Chem. Educ. 55 ,813 (1978)
p-Carboxybenzyl bromide, triphenylphosphine and formaldehyde. HAZARD: formaldehyde is cancer suspect agent.

*ORG ANAL ASPIRIN CONSUMERPROD COURSE PREP PROJ UVIS 2

The Aspirin Project. Laboratory Experiments for General Chemistry.
Brown, D. B.; Friedman, L. B.
J. Chem. Educ. 50 ,214 (1973)
One-semester introductory course for non-science majors, or project for part of a longer course. Involves synthesis from salicylic acid, determination of molecular weight, physical properties, spectroscopic properties, hydrolysis to salicylic acid, and analysis of aspirin tablets.

*ORG GC PREP PROOF 3 4 HAZARD

Styrene Iodochloride: A proof-of-structure experiment
Buckles, R. E.; Knaack, D. F.
J. Chem. Educ. 37 ,298 (1960)
Direction of addition of ICl to styrene studied by analysis of subsequent dehydration and hydration reactions and preparation of derivatives. Could involve nmr. HAZARD: ICl can produce serious burns.

*ORG COLLIG-COLOR NATPROD UVIS 1

Maple Syrup Production as a Laboratory Exercise
Burt, N. E.
J. Chem. Educ. 50 ,623 (1973)
Vis spectrophotometer can be used for grading color, or a color comparator. Maple sap.

*ORG CATALYSIS IR ISOMERS PESTICIDE PHOTO PREP TLC 4 HAZARD

Solid State Photochemical Isomerization: A Convenient Laboratory Experiment
Burton, W. B.
J. Chem. Educ. 56 ,483 (1979)
Photoisomerization of Dieldrin using germicidal lamps, monitored by tlc on silica gel. Benzophenone is used as the sensitizer. Dieldrin, benzophenone and photodieldrin then separated from reaction mixture by preparative tlc. Examined by ir.
HAZARD: Dieldrin is extremely toxic.

*ORG NATPROD PREP SEQ 3 HAZARD

Conversion of Sucrose Into a Carboxylic Acid: An undergraduate experiment
Carman, R. M.; Evans, R. F.
J. Chem. Educ. 46 ,847 (1969)
Sucrose is hydrolyzed, the glucose-fructose mixture converted to the osazone, oxidized by copper(II) to the osotriazole, then by permanganate to 2-phenyl-1,2,3-triazole-4-carboxylic acid. HAZARD: phenylhydrazine is toxic.

*ORG ELECTROCHEM TAUTOMERS 3

Preparative Reduction of Benzil: Use of a Polarographic Analyzer and Simple Current Booster
Carney, J. H.; Mullis, O. J.
J. Chem. Educ. 51 ,343 (1974)
Requires potentiostat or polarograph plus booster and power supply (schematic given). Reduction to benzoin. Rate of tautomerization of stilbenediol can be obtained.

*ORG KIN PREP SUBST.RXN UVIS 3 HAZARD

Relative Rates of Electrophilic Aromatic Substitution
Casanova, J., Jr.
J. Chem. Educ. 41 ,341 (1964)
Rate of bromination in 90% HOAc. HAZARD: bromine

*ORG GAS PREP 3

Student Preparation and Manipulation of a Gas: Methyl Ethyl Ether
Casanova, J., Jr.
J. Chem. Educ. 40 ,41 (1963)
Test tube setup. No vac. rack. Ice-brine baths. Sodium methoxide - ethyl iodide reaction. B. pt., but no other properties measured.

*ORG ANAL ACBA DEMO NATPROD PROJ 1 2

Grape Juice as an Indicator
Castka, J. F.
J. Chem. Educ. 39 ,A43 (1962)
Can be a student project - try oxidizing and reducing agents as well as various acids and bases - pH measured? Other plant colors. A Chem Ed Tested Demo.

*ORG CYCLOADDITION GRIGNARD IR PREP SEQ 4 HAZARD

Preparation of 2,3-Diphenyl-1-Indenone and Related Compounds
Clark, T. J.
J. Chem. Educ. 48 ,554 (1971)
Requires benzalphthalide; Grignard reaction gives title cpd. Hydrogen peroxide epoxidation followed by reaction with methyl acetylenedicarboxylate (caution: irritant) gives dipolar addition. Detailed directions.
HAZARD (avoidable): benzene - carcinogen.

*ORG NAME PREP 3

A Synthesis of o-Chlorocinnamic Acid Utilizing a Meerwein Reaction: An undergraduate organic experiment
Cleland, G. H.
J. Chem. Educ. 55 ,814 (1978)
o-Chloroaniline is diazotized and reacted via a Meerwein reaction with acrylic acid to produce alpha-bromo-o-chlorohydrocinnamic acid. Explicit procedure. Caution: eye and respiratory irritant may be produced in a side reaction.

*ORG PHOTO PREP 3

Photochlorination of Hydrocarbons with Chlorine Generated in Situ
Condon, F. E.; Sokoloff, M.
J. Chem. Educ. 36 ,554 (1959)
Fair yields of chlorocyclohexane have been obtained by irradiating a mixture of cyclohexane, conc. HCl and MnO2. No details or procedure. Caution: Cl2 is generated.

*ORG PHYS KIN PREP 3

Alcohols to Alkyl Halides: A kinetics experiment for elementary chemistry courses
Cooley, J. H.; McCown, J. D.; Shill, R. M.
J. Chem. Educ. 44 ,280 (1967)
Rates followed by direct observation of change in volume of insoluble layer formed in reaction of ROH, HBr, and H2SO4, R = primary and secondary four and five carbon alcohols. Can be used in conjunction with small scale preparation.

*ORG IR NAME NMR PHEROMONES PREP TLC 4

A Student Synthesis of The Housefly Sex Attractant
Cormier, R. H.; Phan, M. D.; Graddis, T.; Singer, R.
J. Chem. Educ. 56 ,345 (1979)
Erucic acid is converted to acid chloride, which reacts with ethoxymagnesium malonate to form ketone. Prep'n of semicarbazone and Wolf Kishner reduction gives Z-9-tricosene. Caution: care should be exercised since it appears to be absorbed into the skin, thereby making the host attractive to male house flies for long periods.

*ORG PREP SUBST RXN 3 HAZARD

Experiments With Electrophilic Aromatic Substitution Reactions
Cox, B.; Kubler, D. G.; Wilson, C. A.
J. Chem. Educ. 54 ,379 (1977)
Prep'n of 1,4-dibromobenzene, 1,2,4,5-tetrabromobenzene, nitrobenzene by optimizing simple conditions. HAZARDS: liquid bromine, benzene.

*ORG APPARATUS PREP 3 HAZARD

Enamine Reactions For The Undergraduate Organic Laboratory: A student water separator
Darling, S. D.
J. Chem. Educ. 43 ,665 (1966)
Making a Dean-Stark water trap is described (hard to follow). Used to make enamine by azeotroping with benzene (HAZARD: substitute toluene) in 1.5 hr. Suggestions for alkylations, acylations.

*ORG ANAL REDOX TLC 1 2 HAZARD

Using TLC to Follow the Oxidation of a Secondary Alcohol to a Ketone
Davis, M.
J. Chem. Educ. 45 ,192 (1968)
Borneol oxidized to camphor by CrO3-H2SO4 (dil), semi-micro. Progress reaction followed TLC. HAZARD: CrO3 is carcinogenic. (Here it could be handled safely, as long as powder not inhaled.)

*ORG DEMO GC 3

The Nitration of Alkylbenzenes: A Lecture Demonstration
Davis, M.; Deady, L. W.; Paproth, T. G.
J. Chem. Educ. 55 ,34 (1978)
Toluene and t-butylbenzene are each nitrated (test tube scale) and products extracted with ether. Solution is injected into glc. Explicit details.

*ORG COLUMNC NAME PHOTO PREP SEQ UVIS 4 HAZARD

The Preparation and Photochemistry of Stilbenes: A synthetic organic chemistry experiment
Davy, J. R.; Jessup, P. J.; Reiss, J. A.
J. Chem. Educ. 52 ,747 (1975)
Multistep synthesis - 4 periods. NBS bromination of p-xylene, followed by reaction with triphenylphosphine. Wittig reaction with p-tolualdehyde requires methyl lithium. Photochemical isomerization of dimethylstilbene to dimethylphenanthrene requires Hg arc lamp, column chromatog.; follow by uv. HAZARDS: benzoyl peroxide, lachrymatory product; lithium metal; Hg arc lamp.

*ORG APPARATUS COLOR QUAL 3

Spot Test for Azo Dye Formation: An Undergraduate Laboratory Experiment
DeGroote, R. A. M. C.; Neumann, M. G.
J. Chem. Educ. 56 ,625 (1979)
Drawing of a device for reproducible spot tests given. Reagents are p-nitrobenzenediazonium chloride and the sodium salt of 1-amino-8-naphthol-3,6-disulfonic acid (H-salt). The spot test is based on the lower solubility and migration rate of the dye compared with the coupling agent or the diazonium salt, and shows if an excess of either is present.

*ORG PREP SEQ 4 HAZARD

Preparation of The Sweetening Agent P4000: A student project
DeKoning, A. J.
J. Chem. Educ. 53 ,521 (1976)
1-Chloro-2,4-dinitrobenzene reacts to form 1-n-propoxy-2,4-dinitrobenzene. Partial reduction gives a mixture of isomers which is separated by basicity. Product is 1-propoxy-2-amino-4-nitrobenzene. HAZARD: 2,4-dinitrochlorobenzene is toxic and a bad vessicant, and product is a cancer-suspect agent. See also Idoux, this file (1972).NOTE: Woollard, J.McK.,J. Chem. Ed. 57, 464 (1980), reports column chromatog. to separate the two isomeric products.

*ORG HETEROCYCLIC PREP SEQ 3

Synthesis of Cyclopentanecarboxaldehyde: An undergraduate organic chemistry experiment
Dev, V.
J. Chem. Educ. 47 ,476 (1970)
Rx seq. begins by treating cyclohexene oxide (from cyclohexene) w. magnesium bromide etherate; then ring opening to the trans diol, and pinacol rearrangement gives product. 11 cyclo- and heterocyclics in the sequence.

*ORG PHYS ISOMERS KIN UVIS 3

Acid and Base Catalyzed Isomerization of delta-5-cholesten-3-one: An experiment in UV/kinetics
Dimmel, D. R.; McKinney, M. A.
J. Chem. Educ. 49 ,373 (1972)
Beckman DU. The isomerization is to delta-4-cholesten-3-one. Both isomers available commercially.

*ORG NATPROD NOPROC PREP SEQ 4

Alpha-Pinene, A Starting Material For a Sequence of Organic Experiments
Dominguez, X. A.; Leal, G.
J. Chem. Educ. 40 ,347 (1963)
Alpha-pinene distilled from turpentine is converted to bornyl chloride, camphene,isobornyl acetate, isoborneol, camphor and others. HAZARD: assorted dangerous reagents are involved, e.g., chromic acid and nitrosyl chloride are cancer suspect agents.

*ORG DRYLAB NMR PROOF 3

Interpretation of a C-13 Magnetic Resonance Spectrum
Dorn, H. C.; Kingston, D. G. I.; Simpers, B. R.
J Chem. Educ. 53 ,584 (1976)
Exercise in deduction of a structure from proton and C-13 nmr spectra of bis(2-ethylhexyl)phthalate.

*ORG QUAL 4

The Sodium Nitroprusside Reagent II - A Solvent Modification
Dougherty, C. M.; Baumgarten, R. L.; Markowska, M.; Battey, Y. C.
J. Chem. Educ. 55 ,341 (1978)
A mixture of 60% tetrahydrofuran/20% ethanol/20% H2O can be used to replace DMSO as a solvent for sodium nitroprusside in testing for aliphatic and aromatic amines. Colors developed when this solvent is used are given.

*ORG NAME PREP SEQ 3

Phthalimide, Anthranilic Acid, Benzyne: An undergraduate organic laboratory sequence.
Dougherty, C. M.; Baumgarten, R. L.; Sweeny, A.; Concepcion, E.
J. Chem. Educ. 54 ,643 (1977)
Explicit directions. Requires tetraphenylcyclopentadienone.

*ORG NMR TAUTOMERS 4 HAZARD

An NMR Study of Keto-Enol Tautomerism in Beta-dicarbonyl Compounds
Drexler, E. J.; Field, K. W.
J. Chem. Educ. 53 ,392 (1976)
Data for 6 candidate compounds given. Study solvent and temperature effects (variable temperature probe). HAZARD (avoidable): CCl4 is carcinogenic.

*ORG CHIRAL GEOM ISOMERS NATPROD POLARIM PREP 3 HAZARD

The Stereochemistry of (-) Menthol: An organic laboratory experiment
Dunathan, H. C.
J. Chem. Educ. 40 ,205 (1963)
(-) menthone, from oxidation of (-) menthol, is treated with acid and mutarotation followed. Reduction of (-) menthone to (+) neomenthone with NaBH4. HAZARD: chromic acid is a cancer suspect agent.

*ORG FRIEDEL.CRAFTS GC IR ISOMERS PREP 3 HAZARD

The Friedel-Crafts Alkylation of Benzene: A first-year organic laboratory experiment
Dunathan, H. C.
J. Chem. Educ. 41 ,278 (1964)
Isomeric butyl chlorides react to give different alkylated benzenes. Products investigated by gc and quantitative ir.
HAZARD (avoidable): benzene.

*ORG NMR PREP 3

NMR Structure Identification of N-(1,1,3,3-Tetramethylbutyl)formamide
Dunn, H. E.; Fairless, B. J.
J. Chem. Educ. 49 ,512 (1972)
Prep'n of title compound from N-(1,1,3,3-tetramethylbutyl)amine • formic acid. Identification requires solvent changes, decoupling and temperature variation to make a complete assignment. Reader (DT) suggests title cmpd should be 2-formylamino-2,4,4-trimethylpentane.

*ORG ANAL PTC QUAL 3

A Classification Test For Aldehydes Involving Phase Transfer Catalysis
Durst, H. D.; Gokel, G. H.
J. Chem. Educ. 55 ,206 (1978)
Not a student experiment but an improved qual. organic anal. test using 4-amino-3-hydrazino-5-mercapto-1,2,4-triazole.

*ORG PHYS DEMO KIN REDOX 1

Methylene Blue: Reduction and Oxidation
Dutton, F. B.
J. Chem. Educ. 37 ,A79 (1960)
Reduction of methylene blue by alkaline dextrose solution; reoxidation (when shaken) with air. A Chem-Ed Tested Demo.

*ORG DEMO ISOMERS PHOTO 3

Cis-Trans Isomerization
Dutton, F. B.
J. Chem. Educ. 38 ,A17 (1961)
Dimethyl maleate converted to dimethyl fumarate in the presence of H2SO4, heat and light. A Chem-Ed Tested Demo.

*ORG DEMO PREP 3

Synthesis of Dimethyl Maleate
Dutton, F. B.
J. Chem. Educ. 38 ,A17 (1961)
From maleic anhydride, methyl alcohol and H2SO4. Distillation, washing, and drying procedures are demonstrated. (The preparation takes 2 hours.) : A Chem-Ed Tested Demo. Warning: maleic anhydride - toxic.

*ORG GC GRIGNARD MISTAKE PREP 3

Grignard Dehydration Reactions
Duty, R. C.; Ryder, B. L.
J. Chem. Educ. 53 ,457 (1976)
Prep of 2,3-dimethyl-2-butanol from 2-bromopropane and dehydration to isomeric 2,3-dimethyl-2-butene and 2,3-dimethyl-1-butene. (Error in structural formula). Analysis by GC. 2 lab. periods.

*ORG PHYS IR NAME REACT SUBST.RXN 4 HAZARD

An Experiment in Activated Aromatic Nucleophilic Substitution
Dyall, L. K.
J. Chem. Educ. 43 ,663 (1966)
Aromatic nucleophilic substitution on picryl compounds. Meisenheimer intermediates. HAZARDS: picryl compounds are explosives, CHCl3 is carcinogenic.

*ORG IR PREP 3

Benzoxazinone Syntheses: An organic chemistry experiment
Eckroth, D. R.
J. Chem. Educ. 49 ,66 (1972)
Five different compounds, some commercially available, some interconvertible, are each converted into one product, 2-methyl-4H-3,1-benzoxazin-4-one. Chemistry is sketchy and not typical.

*ORG DEMO SEPARATION 1 2

Separation of a Mixture
Eddy, R. D.
J. Chem. Educ. 36 ,A37 (1959)
A Chem-Ed Tested Demo. Sugar • C • CaCO3.

*ORG PHYS CLATH DEMO 1 HAZARD

Quinol-H2S Clathrate Compound
Edwards, T. F.
J. Chem. Educ. 35 ,A48 (1958)
Hydroquinone inclusion compound. A Chem-Ed Tested Demo. HAZARD: H2S is a nerve poison.

*ORG GRIGNARD NAME NATPROD PHEROMONES PREP 3

The Synthesis of 4-Methyl-3-heptanol and 4-Methyl-3-heptanone: Two Easily Sythesized Insect Pheromones.
Einterz, R. M.; Ponder, J. W.; Lenox, R. S.
J Chem. Educ. 54 ,382 (1977)
Starting reagents are 1-propanal and 2-bromopentane. Simple apparatus. The ketone is produced by dichromate oxidation of the alcohol. Separation of diastereomers by gc possible.

*ORG PREP 2 3

The Last (?) Word on Student Preparation of Benzalacetophenone
Ellern, J. E.
J. Chem. Educ. 56 ,418 (1979)
Simple preparation.

*ORG GRIGNARD IR MASSPEC NMR NOPROC PREP 3

The Preparation and Spectral Analysis of Toluene-Alpha-D
Ellis, J. W., Buchanan, D. H.
J Chem. Educ. 52 ,265 (1975)
Grignard from benzyl chloride is quenched with D2O.

*ORG ANAL DEMO DISTRIB PHASE TECHNIQUE UVIS 2

A Simple Extraction Experiment
Ellis, L. N.; Fox, M.
J. Chem. Educ. 37 ,510 (1960)
Salicylic acid / n-Butyl Acetate. Vis. spectrophotometer to analyze salicylic acid by color with FeCl3. Colorimetric method used by students. Calc. dist. coeff. Designed to illustrate technique of extraction.

*ORG FRIEDEL.CRAFTS NAME PREP 3

Preparation of Diphenylmethane
Ellis, W. D.
J. Chem. Educ. 40 ,346 (1963)
Modified procedures for Friedel-Crafts alkylation gives better yields, fewer impurities.

*ORG IR NATPROD PREP SEQ 3 HAZARD

The Preparation and Isomerization of Allyl Thiocyanate: An organic chemistry experiment
Emerson, D. W.
J. Chem. Educ. 48 ,8 (1971)
Reaction sequence: allyl bromide to thiosulfate to thiocyanate by reaction with cyanide. Allylic rearrangement to alkyl isothiocyanates. HAZARDS: cyanide, irritants (garlic and horseradish odors).

*ORG LUMIN PREP 3

N-Acetylanthranilic Acid: A Highly Triboluminescent Material
Erikson, J.
J. Chem. Educ. 49 ,688 (1972)
Explicit directions for prep'n, from anthranilic acid, acetic anhydride.

*ORG ANAL BIOCHEM PREP UVIS 3

1,4-Dihydro-3,5-Diacetyl Lutidine: A Basis for Triglyceride Determination in Biological samples
Erikson, J. M.; Biggs, H. G.
J. Chem. Educ. 50 ,631 (1973)
1,4-Dihydro-3,5-diacetyl lutidine synthesized from pentanedione, NH3 and formaldehyde and also by periodate oxidation of glycerol obtained from ester exchange with lipid in biological assay, and determined by UV spectrophotometry, 277 nm. Corn oil or olive oil standard. Unknowns: serum or milk. Explicit procedure. Designed for pre-meds.

*ORG COLUMNC PHOTO PREP TLC 3 HAZARD

The Cyclodehydrogenation of Azobenzene: A photochemical experiment for an undergraduate organic course
Evans, R. F.
J. Chem. Educ. 48 ,768 (1971)
Window light isomerizes protonated trans-azobenzene to benzo(c)cinnoline and benzidine. Separations are not simple. HAZARDS: one product (benzidine) is a potent carcinogen; benzene is also a carcinogen.

*ORG IR PREP SUBST.RXN TAUTOMERS 3

An Experiment to Illustrate Nucleophilic Aromatic Substitution And Tautomerism
Farmer, J. L.; Haws, E. J.
J. Chem. Educ. 47 ,41 (1970)
2-Chloropyridine is hydrolyzed easily. IR shows tautomerism.

*ORG ANAL DEMO QUAL 3

Spot Reaction Experiments
Feigl, F.
J. Chem. Educ. 34 ,457 (1957)
A new series of semimicro reactions for organic analysis and teaching organic chemistry. Pyrolysis of organic compounds w. KNO3, reduction of nitric acid w. benzoyl peroxide; SO2 from thiourea and thioglycolic acids by reaction w. benzoyl peroxide. Spot test used for detection of reaction products, HNO2 and SO2. Suitable for demonstration purposes.

*ORG IR PREP SUBST.RXN 3 HAZARD

Substituent Effects on Aromatic Electrophilic Substitution: An "experimental" class exercise
Ferguson, P. R.
J. Chem. Educ. 48 ,405 (1971)
A first experiment in organic chemistry. Bromination of substituted benzenes; class data on yields, direction and extent of substitution to draw conclusions. HAZARD: benzene is carcinogen, could be omitted.

*ORG MACROCYCLE PREP PTC 3 HAZARD

"Crown Ether" Synthesis: An organic Laboratory Experiment
Field, K. W.; Glover, A. D.; Moroz, J. S.; Collander, D. J.; Kolb, K. E
J. Chem. Educ. 56 ,269 (1979)
Preparation of a furan-acetone macrocyclic polyether by a one-step, two-lab period synthesis. Common lab reagents and techniques. Applications to PTC noted. Information for preparation of macrocycles of furan and other ketones given.
HAZARD. Crown ethers (at least some) are toxic.

*ORG NATPROD PREP TLC 2

Trimyristin From Nutmeg
Frank, F.; Roberts, T.; Snell, J.; Yates, C.; Collins, J.
J. Chem. Educ. 48 ,255 (1971)
Crushed nutmegs are extracted and trimyristin saponified to myristic acid. Used in 'honors' gen. chem. at RPI. 1 lab period. Caution: ether extraction

*ORG PHYS DEMO LUMIN REDOX 2 3

A Simplified Chemiluminescence Demonstration Using Luminol and Hypochlorite Bleach
Fuchsman, W. H.; Young, W. G.
J Chem. Educ 53 ,548 (1976)
Fail-safe method for chemiluminescence from oxidation of luminol with Chlorox.

*ORG PREP PROJ PROOF 3

Indene Reactions: An organic chemistry laboratory problem
Garrison, J. A.
J. Chem. Educ. 47 ,300 (1970)
Prob. is what is structure of indene bromhydrin, prepared by reacting indene with Br2 in KBr. This can be converted to the epoxide, or reduced (Raney nickel + Mg(OH)2) to 1-indanol. Hydroboration of indene gives isomeric indanol. Do not let students read.

*ORG NAME PREP 3

Oxymercuration-Demercuration: An Organic Experiment Involving The Markovnikov Hydration of Olefins
Gibbs, R.; Weber, W. P.
J. Chem. Educ. 48 ,477 (1971)
1-hexene, 1-octene, styrene, etc. yields the secondary alkanols.
Caution: mercury salts are toxic.

*ORG PHARM PREP PROJ 3

Synthesis of Some Unreported Derivatives of Sulfonamides
Gilow, H.
J. Chem. Educ. 56 ,419 (1979)
Preparation of N(4)-benzylsulfanilamide (an antibacterial agent) by reaction of sulfanilamide with benzaldehyde, plus an extension of this general method for synthesis of other N(4)-substituted sulfonamides. Students must prepare a compound and check Chem. Abst. to see if the compound is previously reported.

*ORG PHYS GC ISOMERS KIN PREP SUBST.RXN 3 HAZARD

Subtituent Effects in Electrophilic Aromatic Substitution: A laboratory in organic chemistry.
Gilow, H.
J. Chem. Educ. 54 ,450 (1977)
The acid catalyzed bromination of aromatic substrates with hypobromous acid. General procedure for 10 suitable substrates given. Relative rates by competitive bromination. Product and isomer distribution by quantitative gc (detailed instructions). Open-ended.
HAZARD: Dioxane is a carcinogen.

*ORG PREP REDOX 3 HAZARD

The Oxidation of Primary Alcohols to Aldehydes With Pyridinium Chlorochromate
Glaros, G.
J. Chem. Educ. 55 ,410 (1978)
Safe and clean procedure. Reports successful classroom usage. HAZARD: chromium(VI) compounds are cancer suspect agents.

*ORG FRIEDEL.CRAFTS NAME NMR NOPROC PREP SEQ 3 4

An Intergrated NMR and Synthetic Organic Chemistry Experiment
Glaros. G.; Cromwell, N. H.
J. Chem Educ. 46 ,854 (1969)
Procedures by lit. reference. Includes Friedel-Crafts alkylation, Willgerodt reaction, Claisen-Schmidt, and radical bromination.

*ORG GEOM ISOMERS NAME NMR PHOTO 3

An Integrated NMR and Photochemical Organic Chemistry Experiment
Glaros, G.; Cromwell, N. H.
J. Chem. Educ. 48 ,204 (1971)
NMR spectrum of product of Claisen-Schmidt condensation of 4,4-dimethyl--1-tetralone with benzaldehyde, and its isomerization product when UV irradiated: Z- and E-2-benzal-4,4-dimethyl-1-tetralone.

*ORG NMR 3

Experiments in NMR
Glaros. G., Cromwell, N. H.
J. Chem. Educ. 48 ,202 (1971)
NMR spectra of methanol, methylamine hydrochloride, etc., examined and explained. Rapid proton exchange in methanol is slowed by add'n of acetone and rapid proton exchange in methylamine hydrochloride is slowed by addition of HCl.

*ORG CARBENE PREP PTC 3 HAZARD

Dihalocarbene Insertion Experiment
Goh, S. H.
J. Chem. Educ. 52 ,399 (1975)
Insertion of dichlorocarbene into alpha CH bond of diisopropyl ether using a tetraalkylammonium salt as a phase-transfer catalyst. Identification parameters given. Extensions to bromoform, other substrates. HAZARDS: carbon monoxide evolution; chloroform, carcinogen; isopropyl ether forms explosive peroxide on storage.See Weber, W.P., J. Chem. Ed. 51, 216 (1974).

*ORG CARBENE CYCLOADDITION PREP PTC 3 HAZARD

Dihalocarbene Addition Reaction: An undergraduate laboratory experiment
Goh, S. H.
J. Chem. Educ. 50 ,678 (1973)
Addition of CCl_2 group to cyclohexene using a tetraalkylammonium salt (suggested: Benzyltrimethylammonium chloride) as phase transfer catalyst. Carbene from chloroform (HAZARD) and base.

*ORG INORG ORGANOMETAL POLARIM PREP RESOLUTION SEQ 4 HAZARD

Preparation and Resolution of N,N-Dimethyl-Alpha-Ferrocenylethylamine
Gokel, G. W.; Ugi, I. K.
J. Chem. Educ. 49 ,294 (1972)
Ferrocene start for sequence leading to product, resolved w. (+) tartaric acid salt. Advanced. HAZARD (avoidable): benzene (carcinogen).

*ORG NMR PREP 3 HAZARD

The Ring-Inversion Barrier of 5,5-Dimethyl-1,3-Dioxane: An Introduction to Dynamic NMR
Greenberg, A.
J. Chem. Educ. 49 ,575 (1972)
Compound prepared from paraformaldehyde and 2,2-dimethyl-1,3-propanediol. Fluorotrichlorosilane required. HAZARD: benzene solvent, use a substitute.

*ORG DISTRIB NATPROD SEPARATION 3

Natural Products Isolation - Orange Oil: An undergraduate organic experiment
Greenberg, F. H.
J. Chem. Educ. 45 ,537 (1968)
Limonene is major component of oil isolated by steam dist. and extraction. Charcterization by nmr, ir, gc, refractive index.

*ORG NMR PREP VITAMIN 3 4

The Reaction of Vitamin K-3 With Sodium Bisulfite: An undergraduate organic experiment
Greenberg, F. H.; Leung, K. K.; Leung, M.
J. Chem. Educ. 48 ,632 (1971)
2-Methyl-1,4 naphthoquinone gives two different 1,4-addition products, controlled (thermo. and kinetic) by conditions. NMR differentiates.

*ORG PHYS NMR 3

Group Electronegativity by NMR
Greever, J. C.
J. Chem. Educ. 55 ,538 (1978)
Compounds used are 1-X-propane, where X = chloro, bromo, iodo, amino, nitro, and hydroxy. Explicit procedure.

*ORG APPARATUS DEMO PROJ TECHNIQUE 3

Zone Refining
Greve, R.
J. Chem. Educ. 40 ,A40 (1963)
Simply constructed apparatus for zone melting (refining) of naphthalene. A Chem Ed Tested Demo, suitable for a project.

*ORG NATPROD NOPROC 2 3

Natural Products: An independent study project
Griffin, R. W., Jr.
J. Chem. Educ. 51 ,601 (1974)
Extraction of alkaloids, terpenes, flavonoids requires 3-10 kg. plant material per student. Mostly ideas, little detail.

*ORG ANAL ACBA NOPROC PROJ 3

Identification of an Unknown Ester: An analytical-organic experiment
Grob, R. L., Husk, G. R.
J. Chem. Educ. 46 ,769 (1969)
Unknown esters given students with minimal directions to hydrolyze and identify alcohol and acid. Directions for two alkyl benzoates given. Don't let students read it. 15 hrs. lab time.

*ORG PREP 3 HAZARD

A Modification and Extension of an Elementary Preparation of Ninhydrin
Gruen, H.; Norcross, B. E.
J. Chem. Educ. 42 ,268 (1965)
A modification of a prep. in Fieser, Exp'ts in Org. Chem. uses sodium hydride instead of powdered sodium, and produces an interesting side product. HAZARD: ninhydrin is a known carcinogen.

*ORG GC ISOMERS NOPROC PHOTO 4

The Photoisomerization of Cyclic Ketones: An experiment in organic chemistry
Haas, J. W., Jr.
J. Chem. Educ. 51 ,346 (1974)
Photochemical reactor, 254nm. Cyclopentanone, cyclohexanone, 2-methylcyclohexanone give a variety of photolysis products, analyzed by gc.

*ORG COLUMNC DISTRIB IR NATPROD TECHNIQUE TLC 3

Separation Experiments With Fatty Acids
Hamilton, R. J.
J. Chem. Educ. 55 ,678 (1978)
Transesterification of castor oil gives methyl esters, separated by column chrom., checked TLC. Saponification gives fatty acids, separated by methanol-water partitioning, esterified, and analyzed TLC and ir.

*ORG ANAL GC REDOX 3

Oxidation of Fats: A study using glc
Hamilton, R. J.; Raie, M. Y.
J. Chem. Educ. 49 ,507 (1972)
Olive, linseed, and cottonseed oils oxidized with $KMnO_4$-$NaIO_4$ mixture under conditions which result in the liberation of free fatty acids. These can be injected directly onto a glc column. Standard acid mixture required for calibration.

*ORG KIN NOPROC PREP PROJ SEQ 3

Conversions From Cyclohexanol: An undergraduate laboratory project
Hanna, S. B.; Wrobleski, J. T.; Bohanon, J. T.; Peace, B. W.
J. Chem. Educ. 48 ,556 (1971)
Flow chart for a series of preparations - cyclohexene, adipic acid, cyclohexanediols, caprolactam, cyclopentanone, cyclopentanol, cyclopentene, cyclopentanediols.

*ORG ANAL CHROMATOG IR MASSPEC NMR PROOF TLC 3

Characterization of Juglone
Hanson, R. W.
J. Chem. Educ. 53 ,400 (1976)
Students are given problem of proving that the product prepared by the method of Jesaitis and Krantz is in fact juglone. Method for doing this plus some spectral data given.

*ORG ANAL GC INSTR IR ISOMERS 4

Isomerization of Xylenes: An experiment for the organic or instrumental laboratory
Harbison, K. G.
J. Chem. Educ. 47 ,837 (1970)
Pure o-, m-, and p-xylene isomerized by $AlCl_3$-HCl. Analyzed by ir or gc to find mechanism.

*ORG CATALYSIS DEMO PHOTO PREP SUBST RXN 3

Photochemical Catalysis of an Aliphatic Substitution Reaction
Hart, H.
J. Chem Educ. 38 ,A28 (1961)
Bromination of hexane. A Chem Ed Tested Demo.

*ORG BIOCHEM FREERAD MISTAKE PREP REDOX 3

Oxidative Coupling of Phenols: A biomimetic undergraduate organic laboratory experiment
Hart, H.; Reilly, J. L.
J. Chem. Educ. 55 ,120 (1978)
Lead dioxide oxidation of 2,6-di-tert-butylphenol and radical coupling followed by tautomerization to a hydroquinone. Oxidation gives a quinone. Note: one structure is incorrect. Caution: hydroquinones are potential skin irritants.

*ORG GEOM ISOMERS PREP REARRANGE 3

The Rearrangement of Diazotized 4-Bromobenzophenone Hydrazone: A Stereospecific Reaction
Hawbecker, B. L.
J. Chem. Educ. 47 ,218 (1970)
4-Bromobenzophenone plus hydrazine gives separable syn- and anti-isomers. Separately rearranged to anilides, identified by comparison with products from benzoyl halides and aniline.

*ORG NAME PREP 3

The Aldol Condensation: A simple teaching model for organic laboratory
Hawbecker, B. L.; Kurtz, D. W.; Putnam, T. D.; Ahlers, P. A. Gerrer, G. D.
J. Chem. Educ. 55 ,540 (1978)
Benzaldehyde-acetone base catalyzed reaction gives (1) benzalacetone and (2) dibenzalacetone; only (1) converted to 2,4-dinitrophenylhydrazone. But (our comments) should purify benzaldehyde before start? And uv could be introduced.

*ORG HETEROCYCLIC PREP SEQ 3

Preparation of Phenanthridone - A Multipurpose Experiment for the Organic Laboratory
Hawbecker, B. L.; Radovich, D. A.; Tillotson, L. G.
J. Chem. Educ. 53 ,398 (1976)
Reaction sequence: Conversion of 9-fluorenone to its hydrazone, diazotization, and rearrangment to phenanthridone. One period.

*ORG HPLC ORGANOMETAL 4

Acetylation of Ferrocene. Monitoring a Chemical Reaction by HPLC
Haworth, D. T.; Liu, T.
J. Chem. Educ. 53 ,730 (1976)
Acetylation of ferrocene by acetic anhydride in the presence of phosphoric acid. Ice-quenched samples from reaction batch. Silica column, UV detection, 500 psi.

*ORG COLUMNC CYCLOADDITION NMR PREP 4 HAZARD

Undergraduate Experiments With Tetrachlorobenzyne
Heany, H.; Marples, B. A.
J. Chem. Educ. 45 ,801 (1968)
N-Butyllithium, amyl nitrite, hexachlorobenzene. Tetrachlorobenzyne from hexachlorobenzene plus lithium or tetrachloroaminobenzoic acid diazotized, gives 2 plus 2 cycloaddition to mesitylene or anisole. HAZARDS: tetrachlorobenzene derivatives may be carcinogens. Butyllithium is flammable; amyl nitrite is toxic.

*ORG CARBENE PREP PROJ 4

Transannular Carbene Reactions: An intermediate organic laboratory experiment
Hecht, S. S.
J. Chem. Educ. 48 ,340 (1971)
Reports 5-wk advanced project on study of aprotic decomposition of lithium salts of tosylhydrazones. May involve catalytic hydrogenation (room temp.) and cyclopropane synthesis from CH_2I_2.

*ORG PHYS KIN TITN 3

The Hydrolysis of t-Butyl Chloride: A lecture and a laboratory experiment
Herbrandson, H. F.
J. Chem. Educ. 48 ,706 (1971)
Method of intermittent titration. Data can be collected in about 5 min. per run.

*ORG DEMO PTC 3 HAZARD

Purple Benzene: Solubilization of Anions in Organic Solvents
Herriott, A. W.
J. Chem. Educ. 54 ,229 (1977)
Permanganate ion extracts into benzene when ALIQUAT-336 is added to the system. ALIQUAT-336: comm. prep. tricaprylmethylammonium chloride soln. A tested demonstration.
HAZARD: Benzene is a carcinogen.

*ORG MISTAKE ORGANOMETAL PREP TLC 3

Optimizing Experimental Conditions: The use of TLC to follow the course of a reaction
Herz, J. E.
J. Chem. Educ. 43 ,599 (1966)
Acetylation of ferrocene conditions varied; unreacted, mono and disubstitution products analyzed by tlc. Note: there is only one disubstitution product, rings are free to rotate.

*ORG NAME PTC QUAL 3

A Permanganate Test for Unsaturated Fats Using Phase Transfer Catalysis
Hill, J. W.; Boyd, T. C.
J. Chem. Educ. 56 ,824 (1979)
A Chem Ed compact. Adogen-464 or Aliquat-336 (methyltrialkylammonium chlorides) improves efficacy of Baeyer test. Quantitative also.

*ORG TECHNIQUE 3 HAZARD

Small Scale Organic Techniques: Filtration and crystallization
Horak, V.; Crist, D. R.
J. Chem. Educ. 52 ,664 (1975)
Use of filter stick illustrated by purification of benzanilide. Filter hot solution through cotton, crystallize, withdraw mother liquor, transfer crystals to storage. Explicit with drawings. HAZARD: CCl4, substitute.

*ORG BACTERIA BIOCHEM NATPROD PREP 1 2

Winemaking in The Chemistry Laboratory
Horn, D. E.
J. Chem. Educ. 54 ,375 (1977)
Directions for production of a red table wine as part of a course in chemistry of winemaking. About 4 months minimum.

*ORG EXCHANGE IR PREP 4

The Preparation and Properties of n-Amyl Alcohol-OD: An Exchange Experiment
Hoster, D. P.; Abbott, S.
J. Chem. Educ. 48 ,135 (1971)
Pentyl alcohol and boric acid gives ester, hydrolyzed by D2O. Expensive for any but a single project.

*ORG PREP REDOX 3

Sodium Perborate Oxidation of an Aromatic Amine
Huestis, L.
J. Chem. Educ. 54 ,327 (1977)
4-Chloroaniline to 4,4-dichloroazobenzene and azoxybenzene. Caution: sodium perborate is a solid oxidant.

*ORG PHARM PREP 3 HAZARD

Preparation of Sulfanilamide From Aniline
Hurdis, E. C.; Yang, J. W.
J. Chem. Educ. 46 ,697 (1969)
Modification of usual procedure to save time, eliminating one step. HAZARDS: chlorosulfonic acid, trifluoroacetic acid.

*ORG PHYS FREERAD GC KIN REACT 3 HAZARD

Relative Reactivities in Free Radical Systems
Hutchinson, M. J.; Mosher, M. W.
J. Chem. Educ. 48 ,629 (1971)
GC analysis of start, during and conclusion used to estimate ratios of rates of reaction of each of several free radicals with different hydrocarbons and derivatives. Radical initiators: peroxides, nitrosyl chloride, chlorine are all HAZARDS (strong oxidants, toxic).

*ORG PREP REDOX 3

Selective Reduction of Dinitrobenzenes: An organic laboratory experiment
Idoux, J. P.; Plain, W.
J. Chem. Educ. 49 ,133 (1972)
Ammonium sulfide reagent and NaHS reagent are compared in reaction with 1-substituted-2,4-dinitrobenzenes. See also DeKoning, this file (1976). Warning: skin irritants.

*ORG ASSOC ELECTROCHEM PREP PROJ REDOX SEQ 3 4 HAZARD

Preparation of t-Nitrosobutane Dimer: A combined experiment in organic synthesis and electrochemistry
Iversen, P. E.
J. Chem. Educ. 51 ,489 (1974)
Tungstate-peroxide oxidation of t-butylamine; product electrolytically reduced (for equipment, refer earlier, J. Chem. Educ.) to the hydroxylamine. Polarographic analysis, then bromine oxidation to nitroso compound, t-BuNO, and dimerization to (t-BuNO)2. Explicit directions. HAZARD: bromine.

*ORG APPARATUS ELECTROCHEM PREP 3

Reduction of Trichloroacetic Acid to Dichloroacetic Acid: An organic electrosynthesis experiment
Iversen, P. E.
J. Chem. Educ. 48 ,136 (1971)
Dropping mercury electrode in three-electrode divided cell followed by continuous liquid-liquid extraction. Potentiostat.

*ORG CHIRAL NMR PREP RESOLUTION 4

An NMR Determination of Optical Purity
Jacobus, J., Raban, M.
J. Chem. Educ. 46 ,351 (1969)
In three labs! Resolution of alpha-phenylethylamine (tartrate crystallization) and of O-methylmandelic acid (ephedrine cryst.), conversion of latter to acid chloride, and nmr determinations of optical purity. Uses nmr of all three diastereomers.

*ORG GEOM PHOTO TLC 3 HAZARD

The Photoisomerization of Azobenzene: A TLC experiment for the undergraduate organic laboratory
Janssen, J. F.
J. Chem. Educ. 46 ,117 (1969)
UV light source or sun. HAZARD: benzene.

*ORG HETEROCYCLIC PHOTO TLC 4

Photolysis of a Heterocyclic Compound: An advanced undergraduate experiment
Jarrar, A. A.
J. Chem. Educ. 51 ,755 (1974)
Benzofurazan oxide prepared; reaction with dibenzylmethane gives a quinoxaline-1,4-dioxide. Mercury lamp photolysis gives a benzimidazolone, reactions followed by TLC.

*ORG DIELS.ALDER GRIGNARD PREP PROOF SEQ STEREO 4 HAZARD

Spectroscopy And Structure Elucidation: Coordinated Experimental Exercises in Advanced Organic Chemistry
Jefford, C. W.; McCreadie, R.; Muller, P.; Pfyffer, J.
J. Chem. Educ. 50 ,181 (1973)
Isophorone and methyl Grignard in two different reactions. One with copper acetate gives sat'd cyclic ketone which is then brominated. The other, by subseq. dehydr. gives dienes, one of which reacts (Diels-Alder). HAZARD: benzene - carcinogen. Use another solvent.

*ORG PREP REACT 4

Bridgehead Reactivity: An experiment in organic chemistry
Jefford, C. W.; McCreadie, R.; Muller, P.; Siegfried, B.
J. Chem. Educ. 48 ,708 (1971)
Subl. at red. pressure. Qualitative comparision of rates of nucleophilic substitution of adamantane (by bromination of adamantane), t-butyl bromide, and 9-bromotriptycene (from diazotized anthranilic acid to benzyne plus 9-bromoanthracene). HAZARD: isoamyl nitrite.

*ORG ENVIRON NATPROD PREP 3 HAZARD

Juglone: An organic chemistry-ecology interaction experiment
Jesaitis, R. G.; Krantz, A.
J. Chem. Educ. 49 ,436 (1972)
Synthesis from 1,5-dihydroxynaphthalene by chromic acid oxidation. Acetyl juglone may be prepared from the product. Effect on sprouting of seeds studied. HAZARD: chromic acid is on the carcinogens list.

*ORG IR PREP REDOX 3

The Selective Reduction of Meta- (And Para-) Nitroacetophenone
Jones, A. G.
J. Chem. Educ. 52 ,668 (1975)
Reduction by metal-acid gives amino ketone; by borohydride gives nitroalcohol.

*ORG FREERAD PREP 4

Organoboranes as Alkylating Agents.
Kabalka, G. W.; Baker, J. D., Jr.; Neal, G. W.
J. Chem. Educ. 53 ,549 (1976)
Prep'n of trihexylborane using 1-hexene and borane dimethylsulfide. Reactions of this compound with methyl vinyl ketone under free radical conditions, and also with benzoquinone. 1 lab period. Some discussion.

*ORG NAME PREP 3 4

The Hydroboration-Oxidation of Alkenes: A Convenient Anti-Markownikoff Hydration Experiment
Kabalka, G. W.; Hedgecock, H. C., Jr.
J. Chem. Educ. 52 ,745 (1975)
1-Octene, 1-hexene, etc. hydroborated w. BH3:S(CH3)2 complex. Trimethylamine-N-oxide used as an oxidant. HAZARD: possible carcinogen. Suggest use H2O2 and base, although this is trickier. Needs inert atmosphere.

*ORG CHIRAL HISTORIC IONX POLARIM PROJ RESOLUTION 3

The Resolution of Racemic Acid: A classic stereochemical experiment for the undergraduate laboratory
Kauffman, G. B.; Myers, R. D.
J. Chem. Educ. 52 ,777 (1975)
Low power microscope. Preparation, crystallization and separation of sodium ammonium (+) and (-) tartrates. Additional projects.

*ORG CATALYSIS COLUMNC PREP PROJ 4 5 HAZARD

Student Laboratory Preparation of Cis- and Trans-4-t-Butylcyclohexanols
Kaye, I. A.
J. Chem. Educ. 43 ,535 (1966)
Raney nickel hydrogenation of 4-t-butylcyclohexanone gives mix; hydrogen phthalate is separated. Altered reduction conditions gives more cis, separated by chromatog. Difficult. HAZARD: Raney nickel (pyrophoric), benzene, carcinogenic, use a substitute.

*ORG CATALYSIS HPRESS 3 HAZARD

Catalytic Hydrogenation of Ketones at Moderate Pressures: An organic demonstration-experiment
Kaye, I. A.
J. Chem. Educ. 49 ,131 (1972)
Reduction of ketones by secondary alcohols using Raney-nickel catalyst, at 50 psi. Identification parameters given. HAZARD: Pyrophoric catalyst.

*ORG ADDITION FREERAD NATPROD PHOTO PREP 4 5 HAZARD

Free-Radical Addition of Tetrahalomethanes to Beta-Pinene: Experiments in organic chemistry
Kaye, I. A.; Odum, R. A.
J. Chem. Educ. 53 ,60 (1976)
Three preparations. HAZARD: benzoyl peroxide, carbon tetrachloride, (carcinogen).

*ORG ANAL PREP TECHNIQUE 3

Recrystallization and Melting Point Determination: An introductory organic exercise
Kaye, I. A.; Yuska, H.
J. Chem. Educ. 47 ,703 (1970)
Ketone identification by prep'n of semicarbazones and 2,4-dinitrophenylhydrazones. Unknown.

*ORG DIELS.ALDER PREP 3 HAZARD

A Diels-Alder Student Preparation
Kellett, J. C., Jr.
J. Chem. Educ. 40 ,543 (1963)
Tetracyanoethylene and anthracene. HAZARD: benzene; use another solvent.

*ORG PHYS DEMO HISTORIC 3

A Dramatic and Relevant Demonstration of Ring Strain
Kelly, T. R.
J. Chem. Educ. 54 ,228 (1977)
Addition of cyclobutane-alpha-pinene to crystalline iodine results in an exceptionally exothermic (addition-rearrangment) reaction attended by the evolution of a purple cloud of unreacted iodine. A tested demonstration.

*ORG NAME PREP SEQ 3 HAZARD

The Preparation of 3-Phenylanthranil: A sequential experiment for the undergraduate organic laboratory
Kenny, D. H.; Strieter, J. C.
J. Chem. Educ. 49 ,130 (1972)
o-Benzoyl benzoic acid to o-benzoylbenzamide. 2-Aminobenzophenone (by Hofmann) reacts sod. azide; thermal rearrange gives product. HAZARD: sodium azide (storage hazard, toxic), chloroform (carcinogen).

*ORG NAME PREP 3

The Amine-Catalyzed Perkin Condensation: A class project
Ketcham, R.
J. Chem. Educ. 41 ,565 (1964)
Reaction carried out using a variety of subst. benzaldehydes and phenylacetic acids.

*ORG ANAL QUAL 3

A Simple Test for the Detection of Phosphorus in Organic Compounds
Ketcham, R.; Low-Beer, A.
J. Chem. Educ. 38 ,414 (1961)
Short note reports that filter paper moistened with $AgNO_3$, placed over the mouth of the test tube immediately after a sodium fusion turns black if phosphorus is present.

*ORG ANAL CHROMATOG NOPROC PREP 3

The Unique Properties of 2,4-Dinitrobenzenesulfenyl Chloride
Kharasch, N
J Chem Educ 33 ,585 (1956)
Many reactions of this reagent given Purify chromatographically; experimental details by reference.

*ORG APPARATUS DEMO OPTICAL ORD 2 3

A Device for Easy Demonstration of Optical Activity and Optical Rotation Dispersion.
Kinney, J. B.; Skinner, J. F.
J. Chem. Educ. 54 ,494 (1977)
A portable device is constructed from plexiglass tubing and sheet for the simultaneous demonstration of optical activity and optical rotatory dispersion. Can be used by individuals or with an overhead projector. Qualitative only. A tested demonstration.

*ORG PREP PROJ REARRANGE SEQ 4 5 HAZARD

Intramolecular Reactions: An organic practical project
Knipe, A. C.
J Chem. Educ. 51 ,209 (1974)
4-Nitrobenzenesulfonyl chloride + 2-aminoethanol gives compound which gives base-catalyzed nucleophilic aromatic substitution-rearrangement. Characterizations by ir, nmr, uvis. HAZARD: benzene - use substitute.

*ORG CLATH PREP 3 4

Separation of Organic Compounds with Urea and Thiourea
Kobe, K. A.; Reinhart, L. R.
J Chem. Educ. 36 ,300 (1959)
Urea and thiourea form adducts (inclusion compounds) with many organic molecules. 14 typical compounds are listed plus instructions for forming the clathrates. Avoidable hazard: CCl4 solutions. A very simple, high-yield preparation.

*ORG ASSOC FREERAD GC PREP 3

Two Organic Laboratory Experiments With Benzylic Hydrocarbons.
Kolb, K. E.; Helmer, B. J.
J. Chem. Educ. 56 ,201 (1979)
Preparative dimerization; cumene gives 2,3-diphenyl-2,3-dimethylbutane. Relative reactivity by reaction in gc, and peak height anal.

*ORG PREP REDOX 2 HAZARD

Preparation of Succinic Acid From Maleic Anhydride: A simple organic laboratory reduction
Kolb, K. E.; Pacey, G. E.
J. Chem. Educ. 51 ,345 (1974)
Zn/HCl reduction. HAZARD: maleic anhydride is toxic, irritant.

*ORG IR NMR PREP TLC 3

Preparation of the Members of an Homologous Series: An organic chemistry experiment
Kolenbrander, H. M.
J. Chem. Educ. 47 ,56 (1970)
Synthesis of S-alkyl derivatives of homocysteine, starting with DL-homocysteine thioacetone hydrochloride and a primary iodoalkane. Explicit directions. Not very stimulating.

*ORG APPARATUS CATALYSIS HPRESS ORGANOMETAL PREP 5 HAZARD

Reaction Rates at High Pressures: The Oxo Reaction
Krabacher, B.; Kirch, L.; Orchin, M.
J. Chem. Educ. 37 ,31 (1960)
In an autoclave with hydrogen under 1300 psi, react olefins with CO, using a dicobaltoctacarbonyl catalyst. HAZARDS: the whole experiment is hazardous - toxic compounds and hydrogen at high temperature and pressure.

*ORG APPARATUS FRIEDEL.CRAFTS PREP 3

Apparatus for the Friedel-Crafts Reaction
Kremer, C. B.; Wilen, S. H.
J. Chem. Educ. 38 ,306 (1961)
Simple reaction chamber construction from readily-available glassware. Explicit directions for prep'n of tert-butylbenzene; successful preparation of other compounds reported.

*ORG PREP REDOX 3 HAZARD

Aqueous Chromic Acid Oxidation of Secondary Alcohols in Diethyl Ether
Krishnamurthy, S.; Nylund, T. W.; Ravindranathan, M.; Thompson, K. L.
J. Chem. Educ. 56 ,203 (1979)
Oxidation of 2-methylcyclohexanol in ether. Results given for other sec. alcohols. HAZARDS: chromium (VI) compounds are carcinogens; here there is likely some vapor. Reaction described is highly exothermic.

*ORG ANAL NMR PROJ 4

Illustrating Spectral Simplification by PMR Shift Reagents: An Undergraduate Organic Experiment
Kuo, S. C., Harriss, D. K.; Caple, R.
J. Chem. Educ. 51 ,280 (1974)
Europium and praseodymium shift reagents used to study nmr spectrum of 1,4-dihydroxynaphthalene-1,4-oxide in CDCl3. Part of a projects lab.

*ORG PREP REDOX 3 HAZARD

Use of a New Chemical Reducing Agent in the Undergraduate Organic Laboratory
Kushner, A. S., Vaccariello, T.
J. Chem. Educ. 50 ,154 (1973)
Sodium bis(2-methoxyethoxy)aluminum hydride used to reduce benzophenone to the alcohol. Said to be much less of a fire hazard than lithium aluminum hydride. HAZARD: benzene solution; other solvents now used. Reader (DT) suggests consider NaBH4 synthesis.

*ORG DEMO KIN 3

Substituent Effects on the Benzene Ring: A demonstration
Lambert, F. L.
J. Chem. Educ 35 ,342 (1958)
A series of lecture demonstrations for teaching aromatic chemistry - suitable for classes of approx. 50 students.

*ORG HETEROCYCLIC NATPROD PREP QUAL 3

Hetrocyclic Compounds from Milk
Lampard, M.
J. Chem. Educ. 53 ,256 (1976)
A simple experiment showing the relations between the hexoses and 5-membered heterocyclic compounds, using milk. Mucic acid is obtained by nitric acid oxidation and methods are given for the prep'n of furan, pyrrole, and thiophen, plus tests for their presence.

*ORG KIN 3

A Simple Kinetic Investigation of an Organic Reaction Mechanism
Landgrebe, J. A.
J. Chem. Educ. 41 ,567 (1964)
Hydrolysis of t-butyl chloride in acetone, aq. NaOH. Conc. varied, time for depletion of OH ion (indicator) measured. See also Herbrandson.

*ORG PHYS KIN 3

Chromic Acid Oxidation of Alcohols: A simple experiment on reaction rates
Lanes, R. M.; Lee, D. G.
J. Chem. Educ. 45 ,269 (1968)
Relative rates of reaction of pairs of alcohols followed visually. HAZARD: chromic acid is a carcinogen.

*ORG PREP REVIEW 3

Characterization of Organic Compounds with 2,4-Dinitrobenzenesulfenyl Chloride: procedure and tables
Langford, R. B.; Lawson, D. D.
J. Chem. Educ. 34 ,510 (1957)
A summary of procedures for the preparation of the derivatives of the sulfenyl chloride reagent named in the title. Explicit. Approx. 100 derivatives characterized. 40 references.

*ORG DEMO PREP 3

A Convenient Method for Demonstration of Stable Carbanions
Lansbury, P. T.
J. Chem. Educ. 38 ,307 (1961)
Lithium aluminum hydride in pyridine solution is used 1) for the metallation of triphenylmethane and related weak organic acids whose conjugate bases are highly colored; 2) for the reductive cleavage of benzpinacolone and related ketones to highly colored carbanion solutions. No details. This article merely reports successful use of these reactions as lecture demonstrations.

*ORG ELECTROCHEM PREP REDOX 3

A Simplified Electrolytic Preparation of Iodoform: An anodic organic laboratory experiment
Lariviere, L. M.; Weber, J. E.
J. Chem. Educ. 45 ,54 (1968)
Low voltage DC power source (circuit diagram). Rousch cell oxidation of acetone-potassium iodide. (Really an oxidation of iodide?)

*ORG CONSUMERPROD SEPARATION 3

Caffeine and Benzoic Acid in Soft Drinks
Laswick, J. A.; Laswick, P. H.
J. Chem. Educ. 49 ,708 (1972)
A 1-hr exp't for beginning organic lab. Caffeine is extracted with CH2Cl2, purified by sublimation. Benzoic acid, present as sodium benzoate, can be separately determined.

*ORG DEMO LUMIN PHOSPHOR PHOTO 3

Energy Transfer Demonstrations
Leigh, K. D.
J. Chem. Educ. 50, 848 (1973)
Seven suggested solutions for demonstration of triplet-state processes (phosphorescence), and three for chemiluminescence.

*ORG ACBA CATALYSIS KIN POLARIM 4

Experiments in Acid-Base Catalysis
Leisten, J. A.
J. Chem. Educ. 38, 132 (1961)
Gen. acid catalysis of mutarotation of glucose and specific acid catalysis of dimethyl ketal hydrolysis. Dilatometer. Guggenheim method.

*ORG PHYS KIN PROJ 4

A Group Experiment on the Hammett Sigma-Rho Relation
Leisten, J. A.
J. Chem. Educ. 38, 302 (1961)
A broadening of the familiar Phys. Chem. exp't on the second-order hydrolysis of an ester by aqueous alkali. Each student determines the rate constant for a different ester (a substituted methyl benzoate).

*ORG SEPARATION 3

Oil Formation: An unexpected difficulty in an elementary organic laboratory experiment
Lewis, D. A.
J. Chem. Educ. 52, 601 (1975)
Aniline derivatives are used in a separation procedure which gives oils at first, to challenge the student's recrystallization technique.

*ORG DEMO PREP SEPARATION SOLUB 3 HAZARD

Recrystallization: Unexpected Behavior. An undergraduate organic demonstration or experiment
Lilje, K. C.; Macomber, R. S.
J. Chem. Educ. 50, 567 (1973)
Pyridine hydrobromide (prepared) shows inverted solubility in CHCl3 on heating. HAZARD: chloroform, possibly substitute?

*ORG TAUTOMERS 3

Solvent Effect on The Keto-Enol Equilibrium of Acetoacetic Ester
Lockwood, K. L.
J. Chem. Educ. 42, 481 (1965)
Bromine titration method. Group experiment.

*ORG ANAL STOICH 3

Stoichiometry of the Reaction of Bromine with Phenols
Lockwood, K. L.
J. Chem. Educ. 42, 482 (1965)
Various phenols and bromine in acetic acid. Remaining bromine displaces added iodide which is titrated with std. thiosulfate.

*ORG PREP 3

A More Convenient Method of Preparation of Amide Derivatives of Carboxylic Acids
Long, K. P.
J. Chem. Educ. 56, 420 (1979)
Thionyl chloride with dimethylformamide cat. gives acid chlorides of unreactive acids; used to make amide derivatives for qual. ident.

*ORG IR NMR PREP 4

An Unusual Reaction of a Ketal With Base: An undergraduate organic experiment
Marchand, A. P.
J. Chem. Educ. 49, 841 (1972)
Starting compound is endo-1,2,3,4,5-pentachloro-7,7-dimethoxynorbornene Reaction w. NaOH in DMSO gives compound to identify by nmr, ir. Study questions, suggested extensions. For instructors, not students, to read. WARNING: literature prep of the ketal involves carcinogens.

*ORG MASSPEC NMR PREP PROOF 3

Structural Assignment of a C(10)H(12)O(3) Ester by Mass Spectrometer An Undergraduate Organic Problem
Marchand, A. P.; Jackson, D.
J. Chem. Educ. 53, 390 (1976)
Differentiation of ethyl anisate (ethyl para-methoxybenzoate) from methyl para-ethoxybenzoate, student prep in both cases, by mass spectrometry. NMR is insufficient. Prep methods for both are outlined, mpts, bpts, refractive index and nmr and mass spectra given.

*ORG FREERAD GC QUANT 3 4 HAZARD

Chlorination of 2,3-Dimethylbutane: A quantitative organic chemistry experiment
Markgraf, J. H.
J. Chem. Educ. 46 ,610 (1969)
Chlorination with sulfuryl chloride and N-chlorosuccinimide gives different ratios of products. Also solvent and temp. dependent. Anal. by g.c.
HAZARD: benzoyl peroxide is a storage hazard.

*ORG ISOMERS PREP REDOX SEQ 3 HAZARD

Stereochemical Correlations in the Camphor Series
Markgraf, J. H.
J. Chem. Educ. 44 ,36 (1967)
Isoborneol oxidized by chromic acid to camphor, then reduction with borohydride; competitive oxid. borneol-isoborneol to show steric effect.
HAZARDS: chromic acid, carcinogen.

*ORG ISOMERS NAME PREP PROJ SEQ 4

Stereochemical Correlations in the Norbornane System: An advanced organic experiment
Markgraf, J. H.; Leung, P. T.
J. Chem. Educ. 47 ,707 (1970)
Explicit directions for a reaction sequence. (1) Reaction of 2-norbornanone with methylmagnesium iodide. (2) Prep'n of 2-methylene norbornane by Wittig reaction. (3) Oxymercuration-demercuration of product from (2).

*ORG PREP REARRANGE 3 HAZARD

The Rearrangement of N-Benzyl-N,N-Dimethylhydrazinium Salts
Maytum, D.; Keene, B. R. T.
J. Chem. Educ. 49 ,215 (1972)
N,N-dimethylhydrazine reacts with benzyl bromide, then ylide formed and rearranged by powd. KOH at 110 deg. HAZARDS: (1) benzene, use substitute; (2) dimethylhydrazine is a carcinogen; the product may also be one.

*ORG GC GEOM ISOMERS NMR PREP 3

Dehydration of 3-Hexanol: An nmr experiment for undergraduates
McConnell, J. F.
J. Chem. Educ. 48 ,552 (1971)
Preparative gc on $AgNO_3$/benzyl cyanide on Chromosorb W, separates cis- from trans-. Nmr used on these mixtures.

*ORG NATPROD PREP SEPARATION UV 3

Furfural - Ubiquitous Natural Product
McCullough, T.
J. Chem. Educ. 49 ,836 (1972)
Prepn of furfural from orange rinds, etc., by refluxing with dilute HCl followed by steam distillation, identification by uv, and prepn of 2,4-dinitrophenylhydrazone.

*ORG NATPROD PREP 3

$C_{30}H_{62}O_2$-A Solid Alcohol From Flower Petals
McCullough, T.
J. Chem. Educ. 51 ,228 (1974)
10,11-Triacontanediol from white prickly poppy, and acetylation.

*ORG CHIRAL NMR STEREO TECHNIQUE 4

The Determination of Enantiomeric Purity Using a Chiral Lanthanide Shift Reagent
McGoran, E. C.; Cutter, B.; Morse, K.
J. Chem. Educ. 56 ,122 (1979)
Partially resolved alpha-phenylethylamine is used with chiral shift reagent, compared with calibration spectra of mixtures of known enantiomeric purity.

*ORG CATALYSIS 3 4 HAZARD

Kinetic Vs. Thermodynamic Control: An organic chemistry experiment
McGrew, L. A.; Kruger, T. L.
J. Chem. Educ. 48 ,400 (1971)
Tri-n-butylphosphine cat. dimer vs. trimer from m-chlorophenyl isocyanate.
HAZARD: m-chlorophenyl isocyanate, lachrymator, toxic; tri-n-butylphosphine, toxic, disagreeable odor.

*ORG PREP PTC REVIEW TECHNIQUE 4

Phase-Transfer Catalysis Using Quarternary Onium Salts.
McIntosh, J. M.
J. Chem. Educ. 55 ,235 (1978)
Review of use of PTC in organic reactions. Methyltrialkylammonium chlorides used in example procedures: benzoin condensation, permanganate oxidation, nucleophilic substitution to form a nitrile from 1-chloroactane. 55 references.

*ORG APPARATUS CATALYSIS KIN PREP 4

Liquid Phase Dehydrogenation of Isopropanol: Heterogeneous Catalysis Experiment
Mears, D. E.; Benson, J. E.
J. Chem. Educ. 43 ,325 (1966)
Ni(QAc)2 and CrCl3 reduced w. NaBH4, or substitute Raney nickel. Volume hydrogen used to measure rate. Caution: pyrophoric catalyst.

*ORG HISTORIC ISOMERS MISTAKE 3

The Determination of a Mechanism of Isomerization of Maleic Acid to Fumaric Acid
Meek, J. S.
J. Chem. Educ. 52 ,541 (1975)
Isomerization experiment to deduce mechanism is simple. This description gives history and invites deduction of mechanism from this. It is unique, nice. Errors: test tube #5 should be malic, not maleic acid. In discussion, test tube #4 should be #3. Reader(EM) warns to watch out for several confusing typos.

*ORG ANAL QUAL 3

The Quinhydrone Test for Amines
Meek, W. F.; Entrikin, J. B.
J. Chem. Educ. 41 ,420 (1964)
Classification test for primary, sec. and tert. alkylamines. Also, with more reagent, for aryl.

*ORG POLYMER CONSUMERPROD DEMO PREP 4 HAZARD

Laboratory Preparation of Cellophane
Miller, M.
J. Chem. Educ. 35 ,517 (1958)
Hood: CS2, H2S. Acid-proof goggles, rubber gloves, CS2 in sealed flask at 30 deg. HAZARD: H2S. Possibly for student use in polymer lab, but be careful.

*ORG POLYMER NOPROC PREP PTC REDOX 3

A Topical Alkene Preparation and Oxidation
Mitchell, R. H.; Hawkins, B. F.; West, P. R.
J. Chem. Educ. 56 ,526 (1979)
A Chem Ed Compact. Thermal depolymerization of polystyrene, oxidation of styrene by KMnO4 (1) at room temp with methyltrialkylammonium chloride phase transfer catalyst, and (2) by alkaline reflux.

*ORG CONSUMERPROD SVEX 3 HAZARD

The Extraction of Caffeine From Tea
Mitchell, R. H.; Scott, W. A.; West, P. R.
J. Chem. Educ. 51 ,69 (1974)
Use of teabags and sodium carbonate eliminates messy filtration in this expt. and gives a better product. Explicit directions. HAZARD (benzene) is avoidable.

*ORG DEMO LUMIN PREP 3 HAZARD

A Facile and Effective Chemiluminescence Demonstration Experiment
Mohan, A. G.; Turro, N. J.
J. Chem. Educ. 51 ,528 (1974)
2,4,6-Trichlorophenol or 2,4-dinitrophenol esters of oxalic acid prepared, oxidized by 0.4M H2O2 in dimethyl phthalate, t-butyl alcohol. Chemiluminescence is spectacular. HAZARD: 98% H2O2, a rocket fuel, is an explosive hazard.

*ORG PREP STEREO 3

The Stereospecific Synthesis of Trans-1,4-Disubstituted Cyclohexanes: An organic chemistry laboratory experiment.
Monson, R. S.
J. Chem. Educ. 48 ,197 (1971)
1,4-Cyclohexanediols converted to 1,4-epoxycyclohexane in Dowtherm A over chromatography grade Al2O3. Oxide treated with water and acid, or HCl, or HBr.

*ORG ANAL QUAL 3

Qualitative Test for Ketones, Aromatic Aldehydes, and Aliphatic Aldehydes
Morrison, J. D.
J. Chem. Educ. 42 ,554 (1965)
CrO3 in H2SO4-H2O reagent (caution: CrO3 is carcinogen - here used in minute amounts) in acetone distinguishes aliphatic, aromatic aldehydes; ketones are non-reactive.

*ORG PREP REACT UVIS 3

Preparation and Color of Azo-Dyes
Mosher, M. W.; Ansell, J. M.
J. Chem. Educ. 52 ,195 (1975)
Substituted anilines diazotized and coupled with beta-naphthol. Visible spectrum scanned to find wave length of maximum absorption; this is then correlated with the Hammett sigma constant.

*ORG PHYS CONSUMERPROD PREP SOLUB 1

Antichap Lipstick and Nonbonded Interactions: A Nonscience Majors Laboratory Experiment.
Most, C., Jr.
J. Chem. Educ. 53 ,194 (1976)
Preparation of an antichap lipstick illustrates molecular interactions, solubility, thixotropy.

*ORG CONSUMERPROD PREP 3 HAZARD

Experiencing Relevancy in Organic Chemistry- Hexachlorophene: Manufacturing The Great Clean-All
Moye, A. L.
J. Chem. Educ. 49 ,770 (1972)
2,4,5-Trichlorophenol, paraformaldehyde reaction - easy prep. HAZARD: hexachlorophene, chloroform - carcinogens.

*ORG CONSUMERPROD PHARM SVEX 2 HAZARD

Extraction of Caffeine
Moye, A. L.
J. Chem. Educ. 49 ,194 (1972)
Caffeine from No-Doz instead of tea. Easy. Celite filter pad. HAZARD: chloroform, benzene - avoidable.

*ORG CHIRAL GC IR 3

The Odor of Optical Isomers: An experiment in organic chemistry
Murov, S. L.; Pickering, M.
J. Chem. Educ. 50 ,74 (1973)
Separation of carvone (proced: Runquist, J. Chem. Educ.) from caraway seed oil, spearmint oil. Vac. dist'n.

*ORG CYCLOADDITION DIELS.ALDER PHOTO PREP REACT 3 HAZARD

A Novel Photochemistry Experiment Using a Diels-Alder Reaction
Nash, E. G.
J. Chem. Educ. 51 ,619 (1974)
Hexachlorocyclopentadiene and cyclopentadiene compared in reaction with benzoquinone. Sunlight gives 2+2 photocycloaddition. HAZARD: toxic reactants.

*ORG FRIEDEL.CRAFTS NATPROD PREP 3 HAZARD

Aromatic Nitro Musk Synthesis
Nash, E. G.; Nienhouse, E. J.; Silhavy, T. A.; Humbert, D. E.; Mish, M.
J. Chem. Educ. 47 ,705 (1970)
m-Xylene is starting material: Friedel-Crafts and nitration reactions. Al/Hg amalgam. HAZARD: benzene, carcinogen - avoidable.

*ORG GC NAME NMR PREP 3

The Preparation and Dehydration of 1-Benzylcycloalkenols
Newkome, G. R.; Allen, J. W.; Anderson, G. M.
J. Chem. Educ. 50 ,372 (1973)
Benzylmagnesium chloride reaction with several cycloalkanones followed by oxalic acid dehyd. Ratios of isomeric alkenes by gc and nmr.

*ORG NOPROC PROJ 3

The Synthesis of o-Acetylbenzoic Acid: An experiment for honors organic course
Newman, M. S.
J. Chem. Educ. 54 ,191 (1977)
Describes a student project wherein student suggests method of prep, yield improvement, etc. Some suggested questions; extensions.

*ORG GC ISOMERS 3

A Unique Laboratory-Lecture in Organic Chemistry
Nienhouse, E. J.
J. Chem. Educ. 46 ,765 (1969)
Products from dehydration of 4-methyl-2-pentanol analyzed by gc (peak enhancement).

*ORG NAME PREP 3 HAZARD

The Gabriel Synthesis of Benzylamine: An undergraduate organic experiment
Nigh, W. G.
J. Chem. Educ. 52 ,670 (1975)
Easy prep; ir and nmr given. HAZARD: hydrazine is a carcinogen.

*ORG NAME NATPROD PREP 3

Chemical Modification of Tung Oil
Nitidadhaprabhas, O.
J. Chem. Educ. 55 ,544 (1978)
Fumaric acid adds to tung oil at 200-210 deg. Result is viscous, alkali soluble oil which dries to a varnish.

*ORG NAME PREP PROJ 3

The Hantszch Pyridine Synthesis: A factorial design experiment for the introductory organic laboratory
Norcross, B. E.; Clement, G.; Weinstein, K.
J. Chem. Educ. 46 ,694 (1969)
Starting reagents: aldehydes, ethyl acetoacetate. Design conditions, incl. various oxidants.

*ORG NATPROD TLC 2 HAZARD

Isolation of Oil of Clove and Separation of Eugenol and Acetyleugenol
Ntamila, M. S.; Hassanali, A.
J. Chem. Educ. 53 ,263 (1976)
Short notes describes a "first" experiment wherein a nice-smelling compound is extracted from cloves; characterized by TLC. HAZARD: CHCl3 extraction: substitute something less toxic.

*ORG COLUMNC NATPROD PAPERC PROJ SEPARATION SEQ 3 HAZARD

Natural Product Chemistry: Laboratory research approaches for elementary organic courses
O'Connor, R.
J. Chem. Educ. 42 ,492 (1965)
Extraction of caffeine from coffee beans, purif. by chromatog. and sublim. caffeine from theobromine. HAZARD: CHCl3, benzene - avoidable.

*ORG INORG POLYMER ASPIRIN DEMO PREP 1

Chemistry for Parents and Children
O'Connor, R.
J. Chem. Educ. 37 ,639 (1960)
Curricula and 6 experiments described for a laboratory-oriented "Saturday Science" course. Prep. of MgO, HCl, soap, bakelite, nylon, aspirin. Assorted demos.

*ORG ANAL PREP 4 HAZARD

A Bench-Scale Preparation of Thioacetamide
O'Connor, W. F.; Cogswell, G. W.; Moriconi, E. J.
J. Chem. Educ. 35 ,405 (1958)
From acetamide and P2S5. An exercise for seniors in Organic Processes Lab. HAZARDS: both thioacetamide, and the benzene used as the solvent, are carcinogens.

*ORG PREP 4 HAZARD

Aqueous Bromination With Bromine Chloride: A simplified method for the preparation of 2,6-dibromo-4-nitrophenol
Obenland, C. O.
J. Chem. Educ. 41 ,566 (1964)
p-Nitrophenol reacts with sodium bromide-chlorine. Prep. requires skill. HAZARD: halogens, interhalogens (burns).

*ORG PREP 3

Direct Esterification of Phenols: Textbook errors 48
Offenhauer, R. D.
J. Chem. Educ. 41 ,39 (1964)
Preparation of p-cresyl hexanoate by direct reaction, remove water.

*ORG COLOR PHOTO 3

A Demonstration of Color Development: Formation of the Subtractive Primary Dyes
Olson, E. S.
J. Chem. Educ. 55 ,513 (1978)
Chemistry of color photography applied to an organic lecture demo. Overhead projecter, stacked petri dishes with developed dye.

*ORG PREP 6 HAZARD

Purification of Nitromethane by Crystallization
Parrett, F. W.; Sun, M. S.
J. Chem. Educ. 54 ,448 (1977)
Crystallization from ether at -60 - 78 deg Celsius.
HAZARD: Toxic, explosive. This is a research note, not a student experiment.

*ORG CYCLOADDITION FRIEDEL.CRAFTS ISOMERS PHOTO SEQ 4 HAZARD

Stereospecific Thermal Cycloadditions and Catalyzed Isomerizations: An organic laboratory project
Pasto, D. J.; Duncan, J. A.; Silversmith, E. F.
J. Chem. Educ. 51 ,277 (1974)
Five periods lab report outline given. Friedel-Crafts rx. of benzene with fumaryl chloride yields cis- and trans-1,4-diphenyl-2-butene-1,4-diones. Photochemical rx. of trans- to cis-, and cycloaddition reaction products. HAZARD: benzene and chloroform are carcinogens.

*ORG COLUMNC NAME PREP SEQ TLC 3 HAZARD

The Ethylene Ketal Protecting Group in Organic Synthesis: An undergraduate laboratory experiment
Paulson, D. R., Hartwig, A. L.; Moran, G. F.
J. Chem. Educ. 50 ,216 (1973)
Ethyl acetoacetate to 4,4-diphenyl-3-buten-2-one in three steps, incl. Grignard. HAZARD: benzene (carcinogen) - avoidable.

*ORG ANAL CONSUMERPROD IR NATPROD SVEX UVIS 3 HAZARD

Coffee, Tea, or ...Cocoa: a Trio of Experiments Including the Isolation of Theobromine from Cocoa
Pavia, D. L.
J. Chem. Educ. 50 ,791 (1973)
Isolation of theobromine by CHCl3 extraction and conversion to caffeine with dimethyl sulfite. Hazards: CHCl3 (carcinogen), pure caffeine (toxic).

*ORG NOPROC PREP TECHNIQUE 3

Basic Organic Laboratory Techniques and Problem Solving
Pearson, R. E.
J. Chem. Educ. 46 ,692 (1969)
Nitration of 4-nitrophenol is posed as a problem to students to prove reaction occurred. 4-Nitrophenol and 2,4-dinintrophenol have same mp. Recrystallization techniques developed.

*ORG CHIRAL ISOMERS NMR PREP PROOF 3

Alpha- and Beta-D-Glucose Pentaacetate: An experiment in structure using nmr
Pearson, W. A.; Spessard, G. O.
J. Chem. Educ. 52 ,814 (1975)
For prep., refer: Mohrig & Neckers, Laboratory Experiments in Organic Chemistry, Van Nostrand, 1973.

*ORG NAME PREP 3 HAZARD

The Eschweiler-Clarke Methylation of Amines: An organic chemistry experiment.
Pine, S. H.
J. Chem. Educ. 45 ,118 (1968)
Benzylamine forms tert. amine in easy prep. HAZARD: formaldehyde is low grade (?) carcinogen.

*ORG NATPROD TECHNIQUE 3

An Industrial Steam Distillation: Separation of Rosin and Turpentine From Pine Gum
Potter, F. S.; Schuerch, C.
J. Chem. Educ. 52 ,672 (1975)
100 g. crude pine gum per student, steam dist'n at 200 deg.

*ORG PREP QUAL 3

S-Benzylthiuronium Bicarbonate for the Derivatization of Carboxylic Acids
Reddy, J. V. K.; Boparai, K. S.
J. Chem. Educ. 52 ,324 (1975)
Prep. method for S-benzylthiuronium bicarbonate from the chloride, and its use in preparation of solid derivatives for characterization of carboxylic acids.

*ORG FREERAD GC PREP 4

Inductive Effects in The Chlorination of 1-Chlorobutane: An organic laboratory experiment
Reeves, P. C.
J. Chem. Educ. 48 ,636 (1971)
SO2Cl2 and isobutyronitrile give mixture of products analyzed by gc.

*ORG PREP PTC SUBST.RXN 3 HAZARD

Nucleophilic Substitution by Phase Transfer Catalysis
Reeves, W. P.; White, M. R.; Bier, D.
J. Chem. Educ. 55 ,56 (1978)
Prepn of alkyl thiocyanates from the halides + KSCN using a PTC. Example procedure uses n-butyl bromide in the presence of tetrabutyl ammonium bromide. HAZARD: severe skin irritants and lachrymators.

*ORG PREP 3

Preparation of Acetanilide from Nitrobenzene
Reeve, W.; Lowe, V. C.
J. Chem. Educ. 56 ,488 (1979)
Improved method; 1 lab period. Reduce the nitrobenzene with Fe/HCl, filter, and acetylate the chilled aniline-water mixture with acetic anhydride. The acetanilide precipitates and is purified by recrystallization from water. Detailed instructions.

*ORG PHYS DEMO KIN PH 2

Flashy Solutions
Riley, J. T.
J. Chem. Educ. 54 ,29 (1977)
Hydolysis of t-butyl chloride and t-butyl bromide in the presence of universal indicator produces a sequence of colours in reaction mixture. A tested demonstration.

*ORG DEMO PREP 3

Synthesis of an Azo Dye as a Lecture Demonstration
Robertson, G. R.
J. Chem. Educ. 34 ,566 (1957)
Preparation of phenyl-azo-beta-naphthol from aniline * beta-naphthol. Explicit directions.

*ORG POLYMER PREP 3 HAZARD

Preparation of Terephthaloyl Chloride: Prelude to Ersatz Nylon
Rose, N. C.
J. Chem. Educ. 44 ,283 (1967)
Reaction with piperazine in nylon rope trick. HAZARD: PCl5 (toxic, corrosive); CCl4 (carcinogen), avoidable.

*ORG PREP 3 HAZARD

Hydration of an Alkyne: Undergraduate Organic Chemistry Experiment
Rose, N. C.
J. Chem. Educ. 43 ,324 (1966)
2-Methyl-3-butyn-2-ol hydrated to ketone. One period. HAZARD: benzene, carcinogen, can be avoided.

*ORG PREP SEQ 3 HAZARD

Preparation of 6-Aminosaccharin: A Multistep Synthesis
Rose, N. C.; Rome, S.
J. Chem. Educ. 47 ,649 (1970)
p-Nitrotoluene to product in three or four steps. HAZARD: ClSO3H.

*ORG ANAL COLUMNC NATPROD NOPROC PROJ SEPARATION 3 4

The Essential Oils: A series of laboratory experiments
Runquist, O.
J. Chem. Educ. 46 ,846 (1969)
Individual or pair work to purify (vac. dist'n and column chromatog.), hydrolyze, and identify components of (inexpensive) oils. Lit. work req. Highly recommended. Characterization by ir, nmr, gc, tlc.

*ORG ANAL COLUMNC PREP TLC 2 3

Column and Thin-Layer Chromatography
Ruppel, I. B., Jr.; Cunec, F. L.; Krause, J. G.
J. Chem. Educ. 48 ,635 (1971)
Nitration of phenol; products separated on column, checked TLC. HAZARD: phenol.

*ORG DIELS.ALDER PREP 3

3-Sulfolene: A Butadiene Source For a Diels-Alder Synthesis: An undergraduate laboratory experiment
Sample, T. E., Jr.; Hatch, L. F.
J. Chem. Educ. 45 ,55 (1968)
Maleic anhydride rcts w. 3-sulfolene (ie, 2,5-dihydrothiophene-1,1-dioxide) eliminating SO2. Product is called endo-cis-4-cyclohexene-1,2-carboxylic anhydride; however, while the intermediary is endo-, the final product is not. Suggested extensions. HAZARD (avoidable): benzene.

*ORG ANAL GRAVIM STOICH 2 HAZARD

A General Chemistry Experiment on Clathrates
Sawyer, A. K.
J. Chem. Educ. 41 ,661 (1964)
Hydroquinone clathrates of CH3OH, H2S, molecular ratio determined gravimetrically. Stony Brook uses prep. of the methanol clathrate to teach analytical balance - weigh prepn every week for 6 weeks. We consider the H2S clathrate too dangerous (toxic hazard).

*ORG FREERAD GC PHOTO REACT VACTEK 4

The Gas Phase Free Radical Halogenation of Hydrocarbons: An undergraduate experiment
Scala, A. A.
J. Chem. Educ. 49 ,573 (1972)
Reactions in small sealed tubes, filled on vac. system. Analysis by gc.

*ORG PREP 3

The Synthesis of 2-Nitroresorcinol: An Experiment With Sulfonic Acids
Schaffrath, R. E.
J. Chem. Educ. 47 ,224 (1970)
Illustrates sulfonation to block a reaction site. One period. We (RPI) have repeated expt. Product is not stable.

*ORG GC ORGANOMETAL PREP 4

Reaction of Organocopper Intermediates: An Undergraduate Laboratory Experiment
Schambach, R. A.
J. Chem. Educ. 53 ,735 (1976)
Chemistry of ortho-nitrophenylcopper investigated by systematically varying starting conditions of the copper-quinoline decarboxylation of ortho-nitrobenzoic acid. Prep of cupric nitrobenzoate given, plus decarboxylation procedure. Extensions suggested.

*ORG FRIEDEL.CRAFTS IR NMR PREP 3

Friedel-Crafts Acylation. An experiment incorporating spectroscopic structure determination
Schatz, P. F.
J. Chem. Educ. 56 ,480 (1979)
Procedure given for acylation (acetyl chloride) of 9 aromatic compounds, used as starting materials, and bpts of product ketones. Student prepares one ketone and identifies it unambiguously by IR, NMR spectroscopy.

*ORG NATPROD PREP SEQ 3 4

Synthesis of Chrysanthemic Acid: A multistep organic synthesis for undergraduate students
Schatz, P. F.
J. Chem. Educ. 55 ,465 (1978)
6 lab periods. Starting materials: 3-methyl-2-butenoic acid and 2-methyl-3-buten-2-ol. Five-step convergent synthesis. High vac. dist'n.

*ORG GC NOPROC PREP 3

Alkylation of Methyl Acetoacetate and Gas Chromatographic Analysis of Products
Schimelpfenig, C. W.
J. Chem. Educ. 54 ,446 (1977)
A much more rapid procedure than that of the traditional experiment. Starting reagents are methanol, sodium methoxide, methyl acetoacetate, and bromoethane. "Spiking" technique in gc analysis. Procedure outlined available from author.

*ORG HETEROCYCLIC PREP 3

Laboratory Synthesis of a Heterocyclic Compound
Schimelpfenig, C. W.
J. Chem. Educ. 36 ,570 (1959)
Prep'n of benzofuran oxide by oxidation of o-nitroaniline in alcoholic KOH.

*ORG DEMO DIELS.ALDER 2 HAZARD

The Diels-Alder Reaction
Schimelpfenig, C. W.
J. Chem. Educ. 36 ,A37 (1959)
A Chem-Ed Tested Demo. Anthracene + tetracyanoethylene, both in benzene sol'n. HAZARD: carcinogens (benzene, anthracene).

*ORG ANAL GC 3

A Gas Chromatographic Analysis for the Elementary Organic Laboratory
Schimelpfenig, C. W.
J. Chem. Educ. 39 ,310 (1962)
Alkenes from sulfuric acid dehydration of tert. pentyl alcohol distilled, analyzed. Dow 11 silicone on fire-brick column.

*ORG IR NMR TECHNIQUE 3

Vacuum Distillation Experiment
Schoffstall, A. M.; Specht, J. D.
J. Chem. Educ. 47 ,539 (1970)
Unknown mix is distilled at reduced pressure, identify products by ir, nmr. Uses no fract. column, but 0.1 to 2.0 mm (maybe higher pressure OK?).

*ORG NAME PREP 3 HAZARD

The Hofmann Amide Rearrangement
Schreck, J. O.
J. Chem. Educ. 45 ,670 (1968)
Benzamide reacts to form aniline. Possible intermediates: N-bromobenzamide and phenylisocyanate, are prepared and shown also to give aniline. HAZARD: chloroform is a carcinogen; phenyl isocyanate a persistent lachrymator.

*ORG CARBENE CATALYSIS COLUMNC PREP 3 HAZARD

Basic Alumina: Source of Dihalocarbenes
Serratosa, F.
J. Chem. Educ. 41 ,564 (1964)
Col. chrom. prep. of 7,7-dihalobicyclo(4.1.0)heptane from cyclohexene and haloform. HAZARD: haloforms are carcinogens.

*ORG PREP 3 HAZARD

Amides and Hydrazides From Amine and Hydrazine Hydrochlorides
Shama, S. A.; Tran, T. L.
J. Chem. Educ. 55 ,816 (1978)
Acid chloride reacts with amine salts, producing HCl HAZARD: hydrazines are toxic, possibly carcinogens.

*ORG COLOR PREP 3 HAZARD

New Vat-Dyes Suitable for Student Experiments
Shapiro, R.; Sugerman, G.; Rachbach, H.; Wagreich, H.
J. Chem. Educ. 37 ,526 (1960)
o-Benzoquinone (in situ from catechol oxidation) reacts with aryl amines to form dyes, used to dye wool. Many amines used, so suitable for projects lab. Intermediates investigated chromatog. Dye colors are mixes. HAZARD: aryl amines are potential carcinogens.

*ORG ANAL APPARATUS QUAL 3

The Qualitative Detection of Olefins by Ozonolysis
Sharefkin, J. G.; Ribner, A.
J. Chem. Educ. 37 ,296 (1960)
The suspected olefin is dissolved in a 0.05M 2,4-dinitrophenylhydrazine/ 2M HCl/methanol solution. Ozonized air is then passed through, and the solution tested with alcoholic KOH. The positive test is a deep red color. The main thrust of the paper is the construction of the ozonizer, especially the capacitor assembly. Caution: shock hazard.

*ORG ORG DIELS.ALDER PREP 3 HAZARD

A Diels-Alder Reaction Experiment
Sheppard, W. J.
J. Chem. Educ. 40 ,40 (1963)
Endo-bicyclo(2.2.1)hept-5-ene-2,3-dicarboxylic anhydride from cyclopentadiene (from depolymerization of dimer) and maleic anhydride. HAZARD: benzene, carcinogen, avoidable; maleic anhydride, toxic; cyclopentadiene, irritant odor.

*ORG PHYS CATALYSIS DEMO KIN PREP 3

Demonstrating Acid Catalysis: Preparation of 2,4-dinitrophenylhydrazones
Shine, H. J.
J. Chem. Educ. 36 ,575 (1959)
Into each of 2 small flasks is pipetted 0.2 ml of benzaldehyde and 5 ml of 2,4-dinitrophenylhydrazine sol'n. No reaction is apparent until a drop of HCl is added to one flask. (The other is subsequently acidified with HOAc.)

*ORG HETEROCYCLIC PHOTO PREP SEQ 3

A Photochemical Preparation of Indoles
Shultz, A. G.; Kane, V.
J. Chem. Educ. 56 ,555 (1979)
Reaction sequence. Starting materials are N-methylaniline and ethyl 2-chloroacetoacetate. Final product is ethyl 3-methyl-(N-methylindole)-2-carboxylate. 275 watt sunlamp.

*ORG CYCLOADDITION PREP PROJ 4

Project For a Problem-Oriented Undergraduate Organic or Integrated Undergraduate Laboratory
Silveira, A., Jr.
J. Chem. Educ. 55 ,57 (1978)
Several beta-keto esters converted to monoalkyl derivatives, then to 2-pyrazolin-5-ones, and chlorinated. Base treatment gave unsat'd acids. Extensions. About six weeks. Characterization: nmr, ir, gc.

*ORG ANAL INORG NMR ORGANOMETAL 4 HAZARD

NMR Determination of n-Butyllithium
Silveira, A., Jr.; Bretherick, H. D., Jr.; Negishi, E-I.
J. Chem. Educ. 56 ,560 (1979)
Determination of n-butyllithium in hexane using benzene as an internal standard. HAZARDS: fire hazards; carcinogen.

*ORG IR NMR PREP STRUCT 3

The Reaction Between a Vinylic Ether and 2,4-Dinitrobenzenesulfenyl chloride
Silversmith, E. F.
J. Chem. Educ. 56 ,127 (1979)
Dihydropyran addition, product structure determined by nmr, ir. Two periods - don't let students read article.

*ORG GEOM HEAT IR ISOMERS PHOTO 3

Photochemical and Thermal Interconversion of Cis and Trans Isomers: An organic laboratory experiment
Silversmith, E. F.
J. Chem. Educ. 50 ,568 (1973)
Trans-1,4-diphenyl-2-butene-1,4-dione. 275-Watt sunlamp. Shorter version (part of) Pasto,D.J., J. Chem. Educ. 51, 277 (1974).

*ORG GC IR 3 HAZARD

Verification of Saytzeff's Rule: An integrated experiment for the first-year student
Skinner, A. C.; Davis, J.
J. Chem. Educ. 48 ,653 (1971)
2-Butanol and hot conc. sulfuric acid or 2-bromobutane and alc. KOH. Gas samples for gc, ir; analyze mix prod. HAZARD: hot conc. H_2SO_4.

*ORG PHYS DEMO LUMIN PHOTO 3 HAZARD

A Chemiluminescence Reaction
Slabaugh, W. H.
J. Chem. Educ. 47 ,522 (1970)
Oxidation of the vat dye violanthrone in $CHCl_3$-H_2O_2-NaOH by chlorine. Needs fume hood.
HAZARDS: $CHCl_3$ (carcinogen); 30% H_2O_2, Cl_2 (strong oxidants).

*ORG COLOR COMPLEX DEMO 3

A Simple Lecture Demonstration of Aromatic Nucleophilic Substitution
Smith, N. H. P.
J. Chem. Educ. 52 ,238 (1975)
Reaction of 5 substituted nitrobenzenes with alkoxide in DMF, DMSO, EtOH, develops color (sigma-bonded complexes).

*ORG COLOR DEMO 2 3 HAZARD

A Rapid and Convenient Lecture Demonstration of Dyeing With Azo Compounds
Smith, N. P. H.
J. Chem. Educ. 50 ,790 (1973)
Nitroanilines diazotized, coupled with various naphthols impregnated on cotton fabric. Old demo (Fieser) but some coupling components are new.
HAZARD: one suggested diazo, a benzidine derivative is likely carcinogenic.

*ORG PREP 3 HAZARD

Preparation of P-Anisonitrile
Smith, R. F.; Bates, A. C.
J. Chem. Educ. 46 ,174 (1969)
p-Anisaldehyde, dimethylhydrazine reacted; resulting hydrazone is treated with a base to yield product. One period. HAZARD: N,N-dimethylhydrazine is a carcinogen.

*ORG PREP 3 HAZARD

A Student Preparation of Butyl Ether
Smith, W. B.
J. Chem. Educ. 39 ,212 (1962)
Prep'n from 1-butanol by sulfuric acid cat., azeotrope water (some complicated azeotropes). HAZARD: ethers form explosive peroxides on standing - can be a distillation hazard.

*ORG ANAL NMR 4

Quantitative Analysis Using NMR
Smith, W. B.
J. Chem. Educ. 41 ,97 (1964)
Determination of enol content, deuterium exchange, percent hydrogen in unknowns. Uses A-60; better techniques now available.

*ORG QUAL 3

Calcium Oxide-Zinc Fusion: The Successor to Sodium Fusion in the Undergraduate Laboratory
Snyder, C. H.; Sickels, J. P.; Delvalle, C. J.
J. Chem. Educ. 50 ,72 (1973)
Directions for liquid and solid samples. Caution: occasional vigorous reaction.

*ORG FREERAD PREP 3 HAZARD

The Preparation of 2,4,6-Tri-t-Butylphenol
Somers, B. G.; Cook, C. D.
J. Chem. Educ. 32 ,312 (1955)
Alkylation of phenol with isobutylene, oxidn. first gives colored free radical. HAZARD: Benzene (carcinogen), is avoidable.

*ORG ANAL NMR QUAL 3

Studies for the Organic Qual Lab
Southam, R. M.
J. Chem. Educ. 53 ,34 (1976)
A set of unknowns to analyze for structure by degradation. For instructors eyes only - good practical problems.

*ORG ANAL PHYS COURSE INTEGR NOPROC PROJ 2

A Unified Introductory Chemistry Laboratory
Splittgerber, A. G.; MacLean, D. B.; Neils, J.
J. Chem. Educ. 48 ,330 (1971)
A 14-week introductory lab beginning with preparation of an unknown organic acid and its subsequent identification in later experiments by m.pt., Ksp of silver and copper salts, etc.

*ORG ADDITION DEMO PREP 1

Cracking of Mineral Oil
Stowe, R. E.
J. Chem. Educ. 37 ,A54 (1960)
Bromine vapor is decolorized by vapors from boiling mineral oil. A Chem-Ed Tested Demo.

*ORG INORG COMPUTER IR NMR PREP TECHNIQUE 5 HAZARD

Preparation and NMR Analysis of a Silylthiocarbamate:
An Advanced Laboratory Project
Suydam, F. H.; Yoder, C. H.
J. Chem. Educ. 48 ,849 (1971)
Advanced synthetic techniques lead to a product identified ir, nmr. Variable temp nmr on this. Hazard: Toxic and carcinogenic: COS, ethyl chloroformate, thioacetamide, trimethylchlorosilane.

*ORG GC PREP 3

Dehydration of 2-Methylcyclohexanol
Taber, R. L.; Champion, W. C.
J. Chem. Educ. 44 ,620 (1967)
Dehydrant = 85% phosphoric Acid, analyze product by gc.

*ORG FLUOR HETEROCYCLIC INTEGR PREP PROJ RADIOCHEM 5 HAZARD

Ultraviolet and Fluorescent Spectra of 2,5-Diaryl-1,3,4-Oxadiazoles
Taber, R. L.; Grantham, G. D.
J. Chem. Educ. 47 ,834 (1970)
Prepn of a series of 11 substituted 2,5-diaryl-1,3,4-oxadiazoles, and characterization by TLC, fluorescence spectra,etc. Products can be used in a liquid scintillation counter. HAZARDS: benzene (use something else); acidification of sodium azide (storage hazard) yields hydrazoic acid, not noted as hazardous in the article.

*ORG GC 3

The Dehydration of 3,3-Dimethyl-2-Butanol
Taber, R. L.; Grantham, G. D.; Champion, W. C.
J. Chem. Educ. 46 ,849 (1969)
Product mix is analyzed by gc. Good discussion.

*ORG CHIRAL COMPLEX DEMO 3

A Demonstration of Stereoselectivity
Tapscott, R. E.
J. Chem. Educ. 51 ,586 (1974)
Formation of vanadyl-tartrate complexes. The dextrorotary, racemic and meso complexes have markedly different colors in alkaline solution.

*ORG ANAL QUAL 3

Acids as Derivatives of Aldehydes Prepared with Silver Oxides
Thomason, S. C.; Kubler, D. G.
J. Chem. Educ. 45 ,546 (1968)
Simple modification of aldehyde oxidation to acid.

*ORG IR ISOTOPE NAME PREP 3 HAZARD

The Synthesis and Nitration of Benzene-d(1)
Todd, D.
J. Chem. Educ. 50 ,366 (1973)
Phenylmagnesium bromide + D20, followed by formation of dinitroderivative. Questions. HAZARD: Author says benzene (obviously) unavoidable: take precautions against a carcinogen. The author is one of the Readers.

*ORG PHYS INTEGR KIN PREP TLC UVIS 3 HAZARD

A Laboratory Project in Competitive Aromatic Nucleophilic Displacement
Todd, D.; Lookabaugh, M.
J. Chem. Educ. 49 ,292 (1972)
2,4-Dinitrochlorobenzene reacted with a mixture of aniline + p-anisidine to detn. relative reactivity. Mixed product isolated, separated by tlc and analyzed by abs. spectrophotometry at 360 nm. Integrated.
Hazard: 2,4-DNB is a bad skin irritant.

*ORG ANAL PHYS HITEMP 4 HAZARD

CCl4-reactions at High Temperatures: Illustration of Steric Effects Using Atomic Models
Tsuge, S.; Leary, J. J.; Isenhour, T. L.
J. Chem. Educ. 51 ,266 (1974)
Pyrolysis of CCl4 (HAZARD) in sealed tubes. Reaction products include Cl2, C2Cl6 and C6Cl6. Suggested extensions include GC, etc.

*ORG FREERAD NMR PREP SEQ SUBST.RXN 4 HAZARD

Free-Radical Bromination of p-Toluic Acid: An Experiment in Organic Chemistry
Tuleen, D. L.; Hess, B. A., Jr.
J. Chem. Educ. 48 ,476 (1971)
N-bromosuccinimide bromination (uses spec. glassware but can substitute), then three nucleophilic substit. prod. HAZARD: Benzoyl peroxide, explosive; CCl4, carcinogen, is avoidable.

*ORG NOPROC PHOTO PROJ QUAL 3

A Combined Photochemistry, Organic Qualitative Analysis Experiment
VanDeMark, M. R. R.; Kumler, P. L.
J. Chem. Educ. 50 ,512 (1973)
Photo-oxidation of cyclopentanol, in the presence of iodine and HgO. Students should not know the answer before doing the project.

*ORG CATALYSIS PREP 3

Catalytic Dehydrogenation of Tetrahydrocarbazole
VanVerth, J. E.; Ulmer, S. W.
J. Chem. Educ. 54 ,383 (1977)
5% Palladium-on-carbon catalyst. Warning: high-boiling impurities in reactants will poison catalyst. 1 lab period. Caution: some H2 maybe emitted.

*ORG PHYS CALORIMETRY REARRANGE THERMO 3

A Direct Calorimetric Demonstration of Resonance Energy in The Benzene Nucleus
VanVugt, W. H.; Mosselmann, C.
J. Chem. Educ. 52 ,746 (1975)
Dewar flask and 0.1 deg. thermometer used to measure heat of rearrangement of 3,5-cyclohexadiene-1,2-dicarboxylic acid to phthalic or benzoic acid and 2-cyclohexene-1,2-dicarboxylic acid. Information sheet avilable.

*ORG DIELS.ALDER PREP 3 HAZARD

Two Syntheses for the Organic Undergraduate
Vaughn-Williams, H. R.
J. Chem. Educ. 48 ,259 (1971)
Products are 3,4-phenanthrene(9.10)2,5-diphenylcyclopentadione, and then 4,5-phenanthrene(9.10)3,6-diphenyldihydrophthalic acid by Diels-Alder reaction, from phenanthroquinone, dibenzyl ketone, maleic anhydride. HAZARD: toxic chemicals, especially maleic anhydride.

*ORG PREP 3 HAZARD

An Improved Synthesis of 2-Bromonaphthalene
Vingiello, F. A.; Delia, T. J.; Polss, P.; Farrier, D.
J. Chem. Educ. 40 ,544 (1963)
Three methods; only one recommended is diazotization with CuBr/HBr of 2-naphthylamine-1-sulfonic acid. Do not use prepn. from 2-naphthylamine, a powerful carcinogen (HAZARD).

*ORG ANAL IR SEPARATION

Hydrolysis of Latex Paint in Dimethylsulfoxide: An organic laboratory experiment
Vinson, J. A.
J. Chem. Educ. 46 ,877 (1969)
Alkaline hydrolysis and steam distillation to isolate and identify alcohol by ir (could also be nmr or gc and b.p.). Micro boiling point apparatus.

*ORG ANAL QUAL 3

Organic Qualitative Analysis: An improved sodium fusion and a new test for N and S
Vinson, J. A.; Grabowski, W. T.
J. Chem. Educ. 54 ,187 (1977)
Na/Pb alloy for Na fusion; p-nitrobenzaldehyde color test for cyanide and sulfide ion.

*ORG ANAL ACBA ASPIRIN CONSUMERPROD TITN 2 3

Saponification of Aspirin with Dimethylsulfoxide
Vinson, J. A,; Hocker, E. K.
J. Chem. Educ. 46 ,245 (1969)
Rapid saponification. CAUTION: DMSO absorbed thru skin, carries dirt, etc.

*ORG PREP 3

The Small Scale Preparation of Azobenzene and Hydrazobenzene
Vogel, A. I.; Watling, A.; Watling, J.
J. Chem. Educ. 35 ,40 (1958)
Mg reduction of nitrobenzene to azobenzene and (with excess Mg) to hydrazobenzene. Simple, one period.

*ORG CONSUMERPROD PHARM 3

Drugs in the Chemistry Laboratory. The Conversion of Acetaminophen into Phenacetin
Volker, E. J.; Pride, E.; Hough, C.
J. Chem. Educ. 56 ,831 (1979)
Acetaminophen (N-acetyl-p-aminophenol) is alkylated with ethyl iodide using K2CO3 as a basic catalyst. Starting material Datril, etc. or reagent grade acetaminophen. Explicit instructions.

*ORG PHYS CATALYSIS KIN TAUTOMERS UVIS 3

The General Base Catalyzed Enolization of Acetone: An undergraduate kinetics experiment
Waddington, M. D.; Meany, J. E.
J. Chem. Educ. 55 ,60 (1978)
Within the capacity of most second-semester freshmen but organic mechanism studies are more advanced. Iodination of acetone is followed at 353 nm.

*ORG ANAL COLUMNC GELC ORGANOMETAL PREP 3 HAZARD

An Illustrative and Inexpensive Column Chromatography Experiment
Wade, L. G., Jr.
J. Chem. Educ. 55 ,208 (1978)
Ferrocene and acetyl ferrocene are separated on a silica gel column using chloroform (HAZARD: carcinogen) as the moving phase. Prepn. of acetyl ferrocene given. One 5-hr lab period.

*ORG INORG COURSE IONX TECHNIQUE 1 2

Laboratory Experiments for the Introductory Chemistry Course
Walter, R. I.
J. Chem. Educ. 45 ,672 (1968)
A collection of simple exp'ts, most not new. Includes recrystallization, distillation, oxidation (isopropyl alcohol to acetone, dimethyl maleate to fumarate), ion exchange (separation of iron, cobalt, and nickel).

*ORG COLUMNC CONSUMERPROD PREP 3

An Interesting and Successful Organic Experiment
Wang, B. J-S.
J. Chem. Educ. 51 ,631 (1974)
Reports successful use of prepn. of insect repellant N,N-diethyl-m-toluamide from m-toluic acid, thionyl chloride, diethylamine. Vac. distillation.

*ORG ANAL PHYS KEQ TAUTOMERS 3 HAZARD

Keto-Enol Tautomerism of Ethyl Acetoacetate Experiment in Homogeneous Equilibrium
Ward, C. H.
J. Chem. Educ. 39 ,95 (1962)
Bromine addition to enol is rapid. Add xs bromine to keto-enol system, followed by addition of more than enough beta-naphthol to destroy remaining Br2. Then det'n bromoester by adding xs KI and titrate liberated I2 with std. thiosulfate. HAZARD: Br2.

*ORG KIN SUBST.RXN 3 HAZARD

Bromination of Alkanes
Warkentin, J.
J. Chem. Educ. 43 ,331 (1966)
Relative reaction rates with Br2 in CCl4 (HAZARD: carcinogen) of alicyclic and arylalkyl hydrocarbons. Simple apparatus. HAZARD: Br2, CCl4, etc.

*ORG PHARM PREP 3

A Synthesis of Amphetamine
Wassink, B. H. G.; Duijndam, A.; Jansen, A. C. A.
J. Chem. Educ. 51 ,671 (1974)
From phenylacetone, ethanol, ammonia, aluminum grit and HgCl2, 30 percent characterization data given. Warning: amphetamine is a controlled substance.

*ORG PROJ SEPARATION 2 3

Isolation of Benzoic and Boric Acids From Listerine: An introductory organic chemistry experiment
Weichman, R. L.
J. Chem. Educ. 51 ,589 (1974)
Listerine is analyzed in 3-4 periods. Explicit directions. Characterizations by gc, ir, refractive index.

*ORG CHARGETRANS COMPLEX DEMO PREP 3

A demonstration of charge-transfer complex formation using octachlorofulvalene
West, R.; Smith, R. M.
J. Chem. Educ. 50 ,723 (1973)
2-step prep of octachlorofulvalene from hexachlorocyclopentadiene. Pi-donors (such as pyridine) give intense colors (charge-transfer complex) with this compound in dilute solution.

*ORG COLOR DEMO PHOTO 3

Conversion of Black and White Prints to Color in Daylight: A Demonstration Lecture
Wheeler, T. N.
J. Chem. Educ. 52 ,607 (1975)
Color film (exposed) is developed first in a black and white developer. Then converted to a full color print in the light, using N,N-dimethyl-p-phenylenediamine and three color couplers (cyan, magenta, yellow).

*ORG CATALYSIS HEAT PREP THERMO 3

The Ketene Generator: Simultaneous Exo-Endothermic Reactions.
Whitaker, R. D.; McGarian, T.
J. Chem. Educ. 53 ,776 (1976)
Ketene from acetone catalyzed by a hot copper coil will maintain the coil at red heat, although the reaction is known to be endothermic. Explanation is prob. oxidation of some acetone to CO2 and H2O. Caution: ventilation required. A Tested Demonstration.

*ORG NATPROD PHARM TLC 2 3

Juglone: A Comparison of Natural and Synthetic Products
Wilbur, J. M.; Sublett, K. L.
J. Chem. Educ. 54 ,156 (1977)
Note on extraction of juglone from black walnuts, comparisons with synthetic product of Jesaitis and Krantz, J. Chem. Educ. 49, 436(1972) by tlc, m.p., pharmacological activity - demonstrated by sedation of goldfish.

*ORG PREP 2

A Simplified Preparation of Anthraquinone
Wilcox, C. F., Jr.; Stevens, M.
J. Chem. Educ. 36 ,633 (1959)
Heat a solution of o-benzoylbenzoic acid in conc. sulfuric acid on a steam bath for 30 minutes.

*ORG CATALYSIS PREP 3

Hydrocinnamic Acid: Catalytic Hydrogenation for the undergraduate organic chemistry laboratory
Wilen, S. H.; Kremer, C. B.
J. Chem. Educ. 39 ,209 (1962)
Pd metal is catalyst for transfer hydrogenation - tetralin is dehydrogenated while cinnamic acid is hydrogenated. One period.

*ORG POLYMER PREP PROJ 3 HAZARD

Polystyrene: A multistep synthesis
Wilen, S. H.; Kremer, C. B.; Waltcher, I.
J. Chem. Educ. 38 ,304 (1961)
Reaction series. Benzene is acetylated with acetic anhydride; the acetophenone is reduced with NaBH4 to 1-phenylethanol. This is dehydrated to styrene with KHSO4; the styrene is then polymerized by refluxing with dibenzoyl peroxide. Explicit directions. HAZARD: benzene.

*ORG PROJ TITN 3

Cyclobutane Chemistry: A student laboratory experiment
Williams, F. T., Jr.; Baber, S. C.
J. Chem. Educ. 41 ,563 (1964)
Tetramethyl-1,3-cyclobutanedione (purchase or prep'n ref.) sublimation and conversion to diisopropyl ketone. Base titration of dione is like an ester.

*ORG PHYS INTEGR KIN PREP UVIS 3 HAZARD

Fading of Bromphenol Blue: A combined synthesis and spectrophotometric kinetics experiment
Winans, R.; Brown, C. A.
J. Chem. Educ. 52 ,526 (1975)
Explicit directions for preparation of phenol red, bromphenol blue. Rate of fading followed spectrophotometrically. HAZARDS: bromine, phenol.

*ORG PHYS DEMO LUMIN 1

Chemiluminescence - Variations
Winkel, T. A.
J. Chem. Educ. 37 ,A73 (1960)
Luminol + hemoglobin + sodium perborate + trisodium phosphate + sugar.
A Chem-Ed Tested Demo.

*ORG NMR PREP 3

Conversion of a Primary Alcohol to an Alkyl Halide Via a Tosylate Intermediate
Wiseman, P. A.; Betras, S.; Lindley, B.
J. Chem. Educ. 51 ,348 (1974)
3-Phenyl-1-propanol converted first to tosylate, then to chloride. Students use nmr to find what is happening.

*ORG HETEROCYCLIC PREP PROJ 3 HAZARD

The Synthesis of Heterocyclic Compounds
Wolthius, E.
J. Chem. Educ. 56 ,343 (1979)
A good collection of experiments illustrating the preparation and reactions of N and O heterocyclic compounds. Starting materials are readily available reagents. HAZARD: some dangerous materials: phenylhydrazine.

*ORG GC PREP 3 HAZARD

The Bromination of Anthracene
Wright, O. L.; Mura, L. E.
J. Chem. Educ. 43 ,150 (1966)
Bromination of anthracene or naphthalene, recryst. Detailed. HAZARD: bromine.

*ORG TLC 3

Demonstration of the Relative Nucleophilic Properties of Aromatic Primary Amines
Yeadon, A.
J. Chem. Educ. 48 ,256 (1971)
Reactions of a series of 5 aromatic amines with CH3I followed by periodically withdrawing samples for TLC analysis. SiO2 plates, I2 staining. All relevant Rf's given. Not suitable for lecture demo. Relative reactivities estimated by noting the time for the reaction products to appear.

*ORG GRIGNARD PREP 3 HAZARD

An Organic Experiment to Illustrate Thermodynamic Versus Kinetic Control
Youssef, A. K.; Ogliaruso, M. A.
J. Chem. Educ. 52 ,473 (1975)
Grignard reaction to prepare tetraphenylcyclopentadienone by ref. to O.S. or Fieser, then 1,2,3,4,5-pentaphenyl-2,4-cyclopentadien-1-ol by reaction w. phenylmagnesium bromide. Sodium amide in isopentyl ether at 173 deg. gives one of two isomeric pentaphenylcyclopentenones. 2-3 hr. lab periods. HAZARDS: Sodium amide is very reactive; ethers form explosive peroxides.

*ORG FRIEDEL.CRAFTS PHOTO PREP SEQ 3 HAZARD

Migratory Aptitudes: An organic chemistry experiment
Zaczek, N. M.; Ruff, J. C.; Jackewitz, A. H.; Roswell, D. F.
J. Chem. Educ. 48 ,257 (1971)
Prep. methyl- and chloro- benzophenones by Friedel-Crafts, photochem synthesis of benzopinacols. Rearrangement products are cleaved by pot. t-butoxide to acids, analyzed gc, nmr. Cautions: UV exposure, DMSO may be toxic. HAZARD: benzoyl peroxide is explosion hazard.

*ORG COLUMNC GRIGNARD MASSPEC 4

The Preparation of Naphthalene-Alpha-D
Ziegler, G. R.
J. Chem. Educ. 44 ,609 (1967)
Grignard reaction of 1-bromonaphthalene is quenched w. D2O. Product eluted from column (no details) and analyzed by ir and (optional) mass spect.

*ORG PHYS DEMO ISOTOPE KIN 4

Lecture Demonstration of a Kinetic Isotope Effect
Zollinger, H.
J. Chem. Educ. 34 ,249 (1957)
Explicit directions. Demonstrates a hydrogen-isotope effect. Coupling of 4-chloroaniline with (a) 1-d-2-naphthol-6,8-disulfonic acid and (b) the normal compound. The strongly colored azo compound of the non-deuterated naphthol appears at a visibly faster rate.
Reader (DT) says this was an excellent demo - he saw Z. do it.

*PHYS ORG ACBA DISTRIB KEQ PHASE 3 HAZARD

An Experiment in Coupled Equilibria
Adamson, R.; Parks, P. C.
J. Chem. Educ. 48 ,120 (1971)
Dinitrophenol (DNP) - carbon tetrachloride - water system is characterized by 2 equilibria (1) ionization of DNP in water, and (2) distribution of DNP between CCl4 and water. Analysis for DNP spectrophotometric at 400 nm. Distb. coefficient and pKa; all calcns given. HAZARD : CCl4is a carcinogen - possibly substitute dichloromethane.

*PHYS CRYSTAL MICROSCOPE SOLID 3

A Solid-State Chemistry Experiment: Dislocations in Etched Calcite by Polaroid Photomicrography
Agnew, N. H.
J. Chem. Educ. 49 ,739 (1972)
Requires Polaroid-Land camera, stereomicroscope. Etched pits or cleavage faces show dislocations and orientation.

*PHYS SURFACE 4

Interfacial Spreading: A physical chemistry experiment
Ahmad, J.
J. Chem. Educ. 52 ,534 (1975)
The rate of spreading of oleic acid on a thin layer of glycerol can be measured using very simple equipment and related to surface tension. Surface tension measured independently.

*PHYS ORG CYCLOADDITION DIELS.ALDER KIN UVIS 3 4 HAZARD

A Pseudo First-Order-Second-Order Kinetics Experiment: An Illustration of The Guggenheim Method
Ahmad, M.; Hamer, J.
J. Chem. Educ. 41 ,249 (1964)
Diels-Alder reaction: p-bromonitrosobenzene and 2,3-dimethyl-1,3-butadiene in CH2Cl2 followed by visible spectrometer. Kinetics analyzed by Guggenheim method. HAZARD: nitroso compound may be a carcinogen.

*PHYS NMR PHASE 3 HAZARD

Using NMR to Determine The Boiling Point Diagram For a Non-Ideal Solution
Allen, F. S.; Coleman, W. F.; Morrow, C. J.; Niemczyk, T. M.
J. Chem. Educ. 52 ,132 (1975)
NMR used to determine compositions of condensates. A special boiling flask admits small amount of condensate directly to NMR tube. HAZARD: CHCl3 is a carcinogen.

*PHYS COLOR DEMO OPTICAL QUANTUM UVIS 2

A Simple System for Demonstration in Spectroscopy
Alman, D. H.; Billmeyer, F. W.
J. Chem. Educ. 53 ,166 (1976)
Uses overhead projector, slit, and four layers of diffraction grating in a lantern slide mount, to demonstrate continuous spectra, Planck's radiation law, absorption spectra, fluorescence excitation spectra, reflection spectra, subtractive color mixing, and scattering. A tested demonstration.

*PHYS INORG CLOCK DEMO KIN 2

The Old Nassau Reaction
Alyea, H. N.
J. Chem. Educ. 54 ,167 (1977)
Explicit directions for this clock reaction (also called the Halloween Reaction), plus teaching suggestions. Common lab reagents. A tested demonstration.

*PHYS KIN PHOTO UVIS 3 4

Photohydration of Pyridine in Aqueous Solution: An undergraduate experiment in photochemical kinetics
André, J. C.; Nicleuse, M.; Joussot-Dubien, J.; DeGlise, X.
J. Chem. Educ. 54 ,387 (1977)
Low pressure Hg lamp, quartz cylinder. Absorption max. of pyridine and photoproduct differ, measurements with screens gives rate laws, quantum yields. Seems a very good photochem experiment.

*PHYS APPARATUS LUMIN NOPROC QUANTUM 4

Triboluminescence Spectroscopy of Common Candies
Angelos, R.; Zink, J. I.; Hardy, G. E.
J. Chem. Educ. 56 ,413 (1979)
An exercise to introduce student to spectroscopic aspects of triboluminescence. Spectra compared with the photoluminescence spectra. Block diagram of a triboluminescence spectrometer given.

*PHYS IONSELECT 3

Determination of Activity Coefficients with the Glass Electrode
Annino, R.
J. Chem. Educ. 39 ,240 (1962)
Not a student experiment, though possibly adaptable. Dil HCl media.

*PHYS APPARATUS GC PHASE 5 HAZARD

Determining Activity Coefficients of Liquid in Binary Solutions : A new method
Arnikar, H. J.; Rao, T. S.; Bodhe, A. A.
J. Chem. Educ. 47 ,826 (1970)
Research report. Quantitative glc using gas sampling, with carrier gas saturated with vapor of sample. Data for 6 binary organic liquids, all of which contain at least one suspected carcinogen. Modified gas chromatograph.

*PHYS APPARATUS QUANTUM UVIS 4

The Absorption Spectrum of Sodium Vapor
Ashby, R. A.; Gotthard, H. W.
J. Chem. Educ. 51 ,408 (1974)
Developed for a first course in spectroscopy. Diagram for absorption cell given. Student is to construct atomic energy level diagram for sodium. Molecular absorption can be measured also.

*PHYS CATALYSIS DEMO EXPLOSION KIN REDOX 4

Visual Demonstration of the Catalytic Action of Copper on Methyl Alcohol
Ashmore, R. E.
J. Chem. Educ. 45 ,243 (1968)
An apparatus is described for demonstrating the catalytic effect of CuO on the air-oxidation of methanol. It is said to be safe.
HAZARD: it has been known to explode.

*PHYS ORG GC SEPARATION 3 HAZARD

Fractionating Column Efficiency: Quantitative experiment in elementary organic laboratory
Ault, A.
J. Chem. Educ. 41 ,432 (1964)
Benzene-toluene slow distillation thru column, sample pot and distillate, gc. HAZARD: benzene (carcinogen), substitute.

*PHYS APPARATUS PHOTO REDOX UVIS 4 HAZARD

The Photochemical Oxidation of Aqueous Iodide Solutions: An Experiment Demonstrating The Competitive Reactions of The Hydrated Electron
Ayscough, P. B.; Burchill, C. E.; Ivan, K. J.
J. Chem. Educ. 44 ,349 (1967)
Special reaction vessel. Dilute HClO4. Photochemical yield is followed spectrophotometrically. Vary hydrogen ion, nitrous acid conc. Theory (advanced) discussed. Designed for students in Honors course, final year.
HAZARD: HClO4, storage hazard.

*PHYS APPARATUS ELECTROCHEM TRANSPORT 3 HAZARD

A Modified Moving Boundary Method For Demonstrating Transference Numbers
Baca, G.; Hill, R. D.
J. Chem. Educ. 47 ,235 (1970)
Modified Hittorf method, measures resistance of moving boundary, eliminates indicator error; specially designed cell with constrictions. Here cadmium amalgam is used, made from cadmium shavings. HAZARD: carcinogenic and toxic.

*PHYS APPARATUS ELECTROCHEM 2

Electrochemistry in a Nutshell
Baca, G.; Lewis, D. A.
J. Chem. Educ. 55 ,804 (1978)
9-chamber plexiglas unit gives better results than usual wet-filter paper for rapid measurement of potential of an assortment of cells. Establish electromotive series.

*PHYS ACBA COMPUTER KEQ PH 3

The pKa of a Weak Acid as a Function of Temperature and Ionic Strength: An Experiment Using a pH Meter
Bada, J. L.
J. Chem. Educ. 46 ,689 (1969)
Expanded scale pH meter. May do least squares fit by computer. Constant temperature bath. Straightforward.

*PHYS COMPUTER IR MOL.SPECT 3

A Computerized Physical Chemistry Experiment
Bader, M.
J. Chem. Educ. 46 ,206 (1969)
H or D chlorides, bromides, iodides as gas. Spectral data input to a computer program (available).

*PHYS APPARATUS CALORIMETRY THERMO 3

Use of a Microcalorimeter for Determining Reaction Enthalpies in Solution
Baffier, N.; Letellier, P.; Labbe, J P.
J. Chem. Educ. 53 ,597 (1976)
Modification of an inexpensive differential microcalorimeter to allow reagent injection by microburet described. Student results on neutralization and mixing enthalpies given.

*PHYS KIN TITN 3 HAZARD

Experiment Demonstrating First Order Kinetics
Baginski, E.; Zak, B.
J. Chem. Educ. 39 ,635 (1962)
Iodide-catalyzed reaction of ceric with arsenite, kinetics followed by quenching reaction with Hg(II) nitrate. Unreacted ceric titrated with ferrous to orthophenanthroline. Qual. version gives color changes. HAZARD: CHCl3.

*PHYS AA APPARATUS MOL.SPECT 4

A Novel Method for Measuring Molecular Emission Spectra
Baise, A. I.
J. Chem. Educ. 53 ,58 (1976)
A new method for measuring molecular emission spectra by easy temporary modification of a atomic absorption spectrophotometer has been developed and applied to record the spectrum of the (C2) molecule (Swan bands).

*PHYS ANAL ORG KEQ PH 4

Determination of the Ionization Constant of Sparingly Soluble Weak Acids: An Experiment for Analytical Organic Courses
Baldwin, C. E.; Evans, J. S.
J. Chem. Educ. 51 ,205 (1974)
Potentiometric titration after solubility equilibration gives Ka if Ksp is known. Data given for p-methoxy- and p-nitrobenzoic acids. Const. temp. Estd. time, 1 week.

*PHYS CALORIMETRY THERMO 2

Heat of Combustion of Zirconium : A General Chemistry Experiment
Banks, R. C.; Carter, L.; Peterson, E. R.
J. Chem. Educ. 52 ,235 (1975)
Heat released in firing a flashbulb measured in coffee cup calorimeter. Within capacity of many high school students.

*PHYS DEMO KSP SOLUB 2 HAZARD

The Solubility Product of Cadmium Hydroxide
Barrett, R. L.
J. Chem. Educ. 36 ,A50 (1959)
A Chem-Ed Tested Demo. NaOH sol'n added to Cd^{++} solution until ppt just appears (strong illumination). OH^- concentration in supernatant is est'd from its color with phenol red. HAZARD: avoid Cd^{++}-toxic. Technique should work with other cations.

*PHYS ASSOC ERROR GAS KEQ VACTEK 3

The Dissociation of Acetic Acid Dimer in the Gas Phase
Barton, D.; Ralph, R.; Kane, K.
J. Chem. Educ 45 ,440 (1968)
Standard experiment to measure P vs. T.

*PHYS APPARATUS GAS KIN SOLUB 1 2

A Study of the Physical and Chemical Rates of CaCO3 Dissolution in HCl
Bassow, H.; Hamilton, D.; Schneeberg, B.; Stad, B.
J. Chem. Educ. 48 ,327 (1971)
Reaction is followed by collecting CO2 in a gas buret. Simple apparatus. This experiment was designed for advanced high school students.

*PHYS DEMO KSP QUAL 2

Simultaneous Equilibria Involving Insoluble Salts
Bauman, J. B.
J. Chem. Educ. 54 ,618 (1977)
Red silver chromate (freshly precipitated) is readily converted to white silver chloride by letting it stand in contact with 0.1M NaCl. Supernatant visibly turns yellow as reaction proceeds.

*PHYS ELECTROCHEM THERMO 2

A General Chemistry Thermodynamics Experiment
Beaulieu, L. P., Cpt.
J. Chem. Educ. 55 ,53 (1978)
Temp. coefficient of cell potential for Pb-Pb(II), Cu-Cu(II) battery used to measure entropy change. Thus enthalpy change is determined.

*PHYS ANAL DRYLAB NMR 4

Analysis of Complex NMR Spectra: A Dry-lab Spectral Analysis Experiment
Bell, H. M.
J. Chem. Educ. 54 ,180 (1977)
Analysis of non-first order spectra, specifically those of dimethoxyphenol; 1,2,3-tribromo-2-methylpropane; and 1,1,1-trichloro-3-bromo-3-phenyl-propane in DMSO-d6. Study questions. 7 refs on spectral analysis.

*PHYS ORG COMPUTER DRYLAB NMR PHASE 2 HAZARD

The Acetone-Chloroform System: An NMR Study
Bell, J. A.; Snider, W H.
J. Chem. Educ. 44 ,200 (1967)
NMR spectra given; can be interpreted as hydrogen bond equilibrium. For accelerated Gen. Chem. Could be done as "hands on" experiment.
Hazard: chloroform is now known to be a carcinogen.

*PHYS APPARATUS GAS THERMO UVIS 4

Spectroscopic Determination of Thermodynamic Quantities
Berger, M.; Bell, J. A.; Steel, C.
J. Chem. Educ. 52 ,191 (1975)
Heats of vaporization, sublimation, fusion determined by absorption of vapor in equilibrium with liquid. Data for naphthalene, azobenzene, benzophenone. Diagram of heated cell given.

*PHYS ANAL ORG CATALYSIS KIN UVIS 3

Measurement of Acidic Catalysis: A Physical-Organic Laboratory Experiment
Berndt, D. C.
J Chem. Educ. 48 ,200 (1971)
Klett-Summerson or other visible colorimeter; constant temperature bath. Hydrolysis of benzohydroxamic acid in presence of HCl followed by removing samples from a batch, quenching and color-development by iron(III) chloride.

*PHYS CALORIMETRY KIN 2

Coffee Cup Kinetics
Birk, J. P.
J. Chem. Educ. 53 ,195 (1976)
Rate constants determined for cooling of hot water in various lab vessels. Nice "change-of-pace" experiment.

*PHYS CLOCK KIN 2

A "Clock Reaction" For a Beginning Course in College Chemistry
Black, A. H.; Dodson, V. H.
J. Chem. Educ. 33 ,562 (1956)
Oxidation of oxalate by ceric is followed visually.

*PHYS ORG GLOVEB KIN QUANTUM UVIS 4

Carbonium Ions of Conjugated Molecules: A physical organic experiment
Blatz, P.; Pippert, D.; Sherman, L.; Balasubramaniyan, V.
J. Chem. Educ. 46 ,512 (1969)
Cation from trans-retinyl acetate in 2-propanol-sulfuric acid, spectrum 400-260 nm measured quickly, then after fixed times. Requires dark, cold (-30 C), inert atmosphere, careful techniq_e. Quantum calculations of energy and wavelength on free electron model.

*PHYS CRYSTAL XRAY 3

X-Ray Crystallography "Experiment". Powder Patterns For Alkali Halides
Boer, P. F.; Jordan, T. H.
J. Chem. Educ. 42 ,76 (1965)
NaCl, LiCl, NaBr, NaI, KCl, KBr, KI, CsCl, CsBr, CsI. Densitometer traces given for recognition. No theoretical analysis.

*PHYS APPARATUS DIPOLE 3

A Novel Approach For Dipole Moment Laboratory Experiments: A physical chemistry laboratory experiment
Bonilla, A.; Vassos, B.
J. Chem. Educ. 54 ,130 (1977)
Construction of simple inexpensive app. Results appear precise. Data for chlorobenzene, o-dichlorobenzene.

*PHYS ACBA IONX KEQ 2

Determining Ionization Constants From Ion Exchange Equilibrium Measurements
Bonner, O. D.; Jackson, R.; Rogers, O. C.
J. Chem. Educ. 39 ,37 (1962)
Uses acid ion exchange resin. Results depend on ionic strength (Debye-Huckel) for chloroacetic acids.

*PHYS IR MOL.SPECT QUANTUM 4

C-H Bond Strengths
Boobyer, G. J.; Cox, A. P.
J. Chem. Educ. 45 ,18 (1968)
C-H and C-D fundamental and overtone bands for chloroform, bromoform, 1,1,2-trichloroethene, and 3-bromopropyne measured. Morse and Lippincott-Schroeder functions and dissociation energies calculated.

*PHYS KIN MEMBRANE OSMOSIS 3

An Experiment on Osmotic Flow
Borerro, L. M.
J Chem. Educ. 36 ,244 (1959)
A semipermeable membrane of cupric ferrocyanide is formed in the shape of a drop by the reaction of a cupric sulfate solution containing albumin and sucrose/glucose to a solution of potassium ferrocyanide. As water diffuses into the drop, K2SO4 is formed which eventually causes the visual coagulation of the albumin, allowing the rate of osmosis to be studied.

*PHYS APPARATUS GAS VAPORPRESS 3

Capillary Method For Measuring Saturated Vapor Pressures
Borrell, P.; Nyburg, S. C.
J. Chem. Educ. 42 ,551 (1965)
Capillary with mercury pellet trapping liquid and air mounted in a heating tube with stirrer and thermometer. Method can be used for experiments in Raoult's law derivations (suggested only). Not a student experiment but could be useful.

*PHYS POLYMER DEMO PHOSPHOR UVIS 2

Phosphorescence: A Demonstration
Bramwell, F. B.; Spinner, M. L.
J. Chem. Educ. 54 ,167 (1977)
Directions for making demonstration samples of phosphorescent materials (triphenylene, phenanthrene, naphthalene, biphenyl) activated by uv, in a polymer matrix (methyl methacrylate), for use at room temperature.
A tested demonstration.

*PHYS GAS 1

An Experimental Approach to the Ideal Gas Law
Breck, W. G.; Holmes, F. W.
J. Chem. Educ. 44 ,293 (1967)
Simple apparatus for measuring gas volumes in a closed capillary trapped by mercury. Bath to change temp. Lay flat or invert to get three different pressures.

*PHYS ACBA COMPLEX KEQ UVIS 3

Lewis Acid Base Equilibria: An undergraduate laboratory experiment
Brice, L. K.
J. Chem. Educ. 50 ,430 (1979)
Determination of formation constants of adducts of type MXn:B, where MXn = ZnBr2 and B: = o-,m-,p-nitroaniline. Spec-20, rotocell.
Note: two absorbing species present. Isobestic point at 375 nm.

*PHYS KIN UVIS 2

The Rate of Iodination of Aniline: A physical chemistry experiment
Brice, L. K.
J. Chem. Educ. 39 ,632 (1962)
Iodine plus I- in H2O sol'n. Kinetics followed by titration of residual I2 or spectrophotometrically. Conc. of aniline and pH varied.

*PHYS COORD KIN PREP STEREO UVIS 2

A First Order Rate of Isomerization: A physical chemistry experiment
Brice, L. K.
J. Chem. Educ. 39 ,634 (1962)
Both cis- and trans- bisethylenediaminedichlorocobalt(III) prepared. Cis converts to trans in methanol. Absorption of 540 nm used to get first order plot.

*PHYS IR QUANTUM VACTEK 4

Vibrational Frequencies of Sulfur Dioxide: Determination and Application
Briggs, A. G.
J. Chem. Educ. 47 ,391 (1970)
Double beam ir, gas cell.

*PHYS APPARATUS CRYO PHASE THERMO VAPORPRESS 3

Determination of the Latent Heats and Triple Point of Perfluorocyclobutane. The importance of a simple vapor pressure study.
Briggs, A. G.; Strachan, A. N.
J. Chem. Educ. 54 ,482 (1977)
Portable glass apparatus (requires vac.technique for one-time filling); perfluorocyclobutane and manometer. Measure pressure at temperatures (5 deg. intervals) to -55 deg. C.

*PHYS CATALYSIS CLOCK DEMO KIN OSC.RXN 2 3

An Oscillating Iodine Clock
Briggs, T. S.; Rauscher, W. C.
J. Chem. Educ. 50 ,486 (1973)
KIO3, H2O2, HClO4 OR H2SO4, malonic acid, MnSO4. Gives visible fluctuation in iodine concentration (starch). Many variants suggested.

*PHYS INORG KEQ KIN REDOX TITN UVIS 3

Static and Kinetic Measurements of an Equilibrium Constant: A physical-inorganic chemistry experiment
Britton, D.; Hugus, Z Z., Jr.
J Chem. Educ. 40 ,607 (1963)
Equilibrium constant of arsenic acid-iodide reaction is determined by direct titration and calculated from spectrophotometric data.

*PHYS APPARATUS KIN UVIS VACTEK 3

The Kinetics of Nitrogen Atom Recombination: An undergraduate physical chemistry experiment
Brown, G. R.; Winkler, C. A.
J. Chem. Educ. 54 ,185 (1977)
N atoms generated in flow system by microwave or by elect. discharge and measured indirectly spectrophotometrically.

*PHYS ANAL ACBA COLOR KEQ UVIS 3

Acid-Base Indicators: An experiment in aqueous equilibria
Brown, W. E.; Campbell, J. A.
J. Chem. Educ. 45 ,674 (1968)
Absorbances of six acid-base indicators, discussion of purity.

*PHYS INORG COORD MAGNETIC 3

Magnetic Susceptibility: A physical chemistry laboratory experiment
Brubacher, L. J.; Strafford, F. E.
J. Chem. Educ. 39 ,574 (1962)
Solids measured in Gouy balance, with varying field strength electromagnet. Iron(II) ammonium sulfate hexahydrate standard.

*PHYS COORD KIN UVIS 3

Correlation Between Ligand Field Theory and Complex Dissociation: A kinetics experiment
Brumfitt, G.
J. Chem. Educ. 46 ,250 (1969)
o-Phenanthroline and 5-nitro-1,10-phenanthroline complexes of divalent Co, Ni, Cu. Kinetics of decomposition by mercuric nitrate. Requires thermostatted cell.

*PHYS KIN REDOX TITN 3

Activation Energy Determination: An organic chemistry experiment
Bryan, A. M.; Olafsson, P. G.
J. Chem. Educ. 46 ,248 (1969)
Decomp. of N-bromobenzamide in base, followed by thiosulfate titration. Within capacity of many freshmen.

*PHYS ORG KIN UVIS 3

A Spectrophotometric Kinetic Experiment Illustrating Consecutive Reactions-The Methanolysis of Methyl p-Nitrophenyl Sulfate
Buncel, E.; Raoult, A.; Wiltshire, J. F.
J. Chem. Educ. 51 ,814 (1974)
Requires thermostatted cell, scanning UV spectrophotometer. Preparation of methyl p-nitrophenyl sulfate from Can. J. Chem. ref. Reaction followed by scanning UV spectrum.

*PHYS ELECTROANAL FASTREACTION KIN 3

Kinetics of Fast Brominations: A Potentiometric Study
Burgess, A. E.; Latham, J. L.
J. Chem. Educ. 46 ,370 (1969)
Kinetics of bromate/bromide reaction studied by bromination of various phenols in aq. sol'n, reaction followed potentiometrically. Simple apparatus, one lab period.

*PHYS COORD DEMO KEQ 2

Chemical Equilibrium
Burke, B. A.
J. Chem. Educ. 54 ,29 (1977)
Colorless aq. KBr added to blue aq. $CuSO_4$ gives green solution of K_2CuBr_4; reversed by excess sulfate ion and by warming. A tested demonstration.

*PHYS ORG DRYLAB GAS MASSPEC

An Interpretive Experiment in Ion Cyclotron Resonance Spectroscopy
Burnier, R. C.; Frieser, B. S.
J. Chem. Educ. 56 ,687 (1979)
Intended to provide the student with experience in analyzing ICR spectra. Methane (ions) and ions derived from mixtures of methane plus org. bases.

*PHYS KIN LUMIN PHOTO 4

Uranyl Luminescence Quenching: An experiment in photochemistry and kinetics
Burrows, H.; Formsinho, S. J.
J. Chem. Educ. 55 ,125 (1978)
Quenching by microliter amounts of alcohols gives information on mechanism. Stern Volmer kinetics.

*PHYS INORG ACBA APPARATUS COORD DEMO KEQ 1

Chemical Equilibrium
Butler, S. B.
J. Chem. Educ. 37 ,A73 (1960)
A Chem-Ed Tested Demo. A Soxhlet extractor is used a) to demonstrate the change in color of $CoCl_2$ with hydration, b) $Bi^{+++}/BiOCl$ equilibrium with change in acidity. In one case, there is a color change when the Soxhlet extractor empties; in the other there is a change from a turbid to a clear solution.

*PHYS ANAL ORG PREP TCHROM THERMO UVIS 3 4

Thermodynamic Data From The Thermochromic Effect
Byrne, J. P.
J. Chem. Educ. 55 ,267 (1978)
Preparation of a spiropyran from 1,3,3-trimethyl-2-methylindoline and 2-hydroxy-1-naphthaldehyde (references given). Recording visible spectrophotometer with heated cell (30 to 70 degrees). Beers law plot to get concentrations.

*PHYS COMPUTER DRYLAB KIN 3

Laboratory-Equivalent Minicomputer Experiments: A kinetic application
Cabrol, D.; Cachet, D.; Basso, J. H.
J. Chem. Educ. 52 ,266 (1975)
Simulation experiments. Interactive program. Computers-in-chemistry experiment.

*PHYS INORG DEMO REVIEW 2

Sealed Tube Experiments
Campbell, J. A.
J. Chem. Educ. 47 ,273 (1970)
A collection of 64 experiments exemplifying practically everything taught in General Chemistry. Not all are sealed tube. Intended for lecture demo,. but many are suitable for student exp'ts. But don't let students read; these are not cook-book, but ideas.

*PHYS COURSE KEQ KIN NOPROC PHASE UVIS VACTEK 2 3

What Goes on in the Laboratory?
Campbell, J. A.
J. Chem. Educ. 42 ,488 (1965)
Examples of experiments in a three-semester general and physical course at Harvey-Mudd. Emphasis on minimal student direction, problem solving.

*PHYS COMPUTER DISTRIB ERROR TITN 3 HAZARD

A Distribution Experiment
Campbell, J. A.; Nelson, D.; Rudesill, J.
J. Chem. Educ. 46 ,454 (1969)
Careful procedures in measuring distribution of aliphatic acids between water and organic solvents includes aq. and non-aq. acid-base titration. HAZARD: avoid $CHCl_3$ and benzene, carcinogens.

*PHYS PHASE SEPARATION 3 HAZARD

Fractional Distillation: A laboratory experiment
Campbell, R. D.
J. Chem. Educ. 39 ,348 (1962)
HETP det'n with different reflux ratios, pressures, columns. HAZARD: benzene and chloroform are carcinogens.

*PHYS DEMO GAS 2

Balloon Balance Thermometer. A Lecture Demonstration of Charles' Law.
Carney, G. D.; Kern, C. W.
J. Chem. Educ. 56 ,823 (1979)
The "balloon-balance" thermometer makes use of air as a thermometric fluid, a water bath as a thermometric vessel, and the reading of the triple beam-balance as the thermometer scale. Detailed presentation. Extrapolate to find -273 deg. with 10% accuracy.

*PHYS AVOGADRO HISTORIC 2

Estimation of Avogadro's Number
Carroll, K. L.; Neilsen, E. K.
J. Chem. Educ. 35 ,198 (1958)
A tenth of a millimeter of a standard oleic acid/pentane solution is placed on a water surface covered with a film of "oxidized piston oil" and dusted with lycopodium powder. The height of the oleic acid layer = 1 molecular dimension can be estimated from h x A(film) = w/density (oleic acid). This exp't became a standard "first experiment". Complete calculations given.

*PHYS APPARATUS DENSITY KIN MICELLE 3

Density Measurements With a Magnetically Controlled Float
Cartan, F.; Anacker, E. W.
J. Chem. Educ. 37 ,36 (1960)
Complete construction details. Used to det'n critical micelle conc., rate constant for acetal hydrolysis, densitometric titrations, and partial molal volumes.

*PHYS CLOCK KIN NAME 2

Faster Than a Speeding Bullet: A freshman kinetics experiment
Cassen, T.
J. Chem. Educ. 53 ,197 (1976)
Formaldehyde clock, measuring dependence on conc. A, conc. B, temp.

*PHYS DEMO LASER MOL.SPECT UVIS 1

Demonstrations for High School Chemistry: Uses of He-Ne Laser
Castka, J. F.
J. Chem. Educ. 53 ,573 (1976)
Helium-neon laser does not give surface photoelectric effect with Zn, whereas UV radiation does. Wavelength measured.

*PHYS APPARATUS SOLUB THERMO 3

Heats of Solution From Solubility Determinations
Cesaro, A.; Russo, E.
J. Chem. Educ. 55 ,133 (1978)
App. designed to give quick, accurate solubility determinations as a function of temp. Enthalpy from van't Hoff plot.

*PHYS ANAL ACBA DEMO KEQ PH 2

A Buffer Solution and Its Action
Chang, J. C.
J. Chem. Educ. 53 ,228 (1976)
Simple demo of effect of addition of acids, etc., to acetate buffers. Uses a "projection pH meter".

*PHYS ORG APPARATUS GAS KIN STOICH 3

A Stoichiometric Study in The Gas Phase: Bromination of Unsaturated Hydrocarbons
Charlson, A. J.; Shapiro, J. S.; Ware, G. W.; Watton, E. C.
J. Chem. Educ. 55 ,338 (1978)
Bromine vapor reacted with excess gaseous olefin to yield liquid products. Stoichiometry and kinetics followed by pressure change. Seems awkward, and results in some cases do not correspond with theory.

*PHYS DEMO KIN 2

A Color Indicating Time Reaction
Chen, P. S.
J. Chem. Educ. 47 ,A78 (1970)
Reaction of Fe*3 ion w. thiosulfate gives a sequence of colors due to complex formation, then redox.

*PHYS ELECTROANAL KEQ 2

Potentiometric Measurements of Equilibria in General Chemistry Laboratory
Chesick, J. P.; Patterson, A., Jr.
J. Chem. Educ. 36 ,496 (1959)
Det'n of Ksp of AgCl, Ka of acetic acid, and Kf of silver-ammonia complex in 1 lab period. Inexpensive potentiometer.

*PHYS APPARATUS ELECTROANAL KIN 3

Determination of Reaction Rates With an A.C. Conductivity Bridge: A student experiment
Chesick, J. P.; Patterson, A., Jr.
J. Chem. Educ. 37 ,242 (1960)
Hydrolysis of t-butyl chloride followed using an inexpensive AC conductance bridge (circuit diagram). Guggenheim analysis. Developed for freshman honors.

*PHYS APPARATUS THERMO VACTEK 3

A Simple Equilibrium Method For Determining Heats of Sublimation
Chickos, J. S.
J. Chem. Educ. 52 ,134 (1975)
Sample at temp-1 is equilibrated with an evacuated ballast tank maintained at temp-2. After equil., sample compartment is closed off and vapor condensed. Enthalpy from Clapeyron eq'n. Thymol, etc. Not written as a student experiment, but adaptable.

*PHYS GAS 2

Ideal and Non-Ideal Gases: An experiment with surprise value
Chirpich, T. P.
J. Chem. Educ. 54 ,378 (1977)
Simple experiment intended to promote abstract thinking, understanding of kinetic molecular theory. Compares pressure change in cooling air (extrapolates Charles' Law) with that in cooling water vapor. No black box.

*PHYS DTA PHASE 2 3

Phase Diagram of The Lead-Tin System by Differential Thermal Analysis
Chiu, G.
J. Chem. Educ. 55 ,205 (1978)
Straightforward.

*PHYS DEMO GAS SURFACE 2

Bubble Pressure And Volume
Christian, S. D.; Enwall, E.
J. Chem. Educ. 55 ,536 (1978)
Logic experiment interprets pressure change with volume. Black box contains a tube open to soap film.

*PHYS ORG DISTRIB NMR PHASE 4 HAZARD

A Study by NMR of a Three-Component System: A physical-organic experiment
Claasen, R.; Wolcott, R.; Reirbold, P. E.
J. Chem. Educ. 55 ,542 (1978)
$CHCl_3$, acetic acid, water in various proportions are phase equilibrated. Phases separated and nmr (integrated) used to det'n composition. HAZARD: chloroform is a suspected carcinogen.

*PHYS KIN 3 HAZARD

The Kinetics of The Bromate-Bromide Reaction
Clarke, J. R.
J. Chem. Educ. 47 ,775 (1970)
Followed by bromination of phenol aliquot in dilute $HClO_4$ solution. Excess bromine bleaches methyl orange. Two 3-hr lab periods if stock solutions supplied. Rate constants, orders in reactants and activation energy calculated. Author says phenol-$HClO_4$ mixtures, being dilute, are not hazardous. The bibliographers disagree: they are a serious storage hazard even if they have not yet detonated while in use.

*PHYS PHASE REFRACT 3

Tie Lines in Phase Diagrams for Ternary Liquid Systems
Clarke, J. R.
J. Chem. Educ. 51 ,225 (1974)
1,2-Dichloroethane-water-acetic acid system by refractometry. Refractive indices, phase diagram given.

*PHYS INORG NOPROC UVIS 4 5

The Application of Diffuse Reflectance Spectroscopy to Inorganic Chemistry
Clark, R. J. H.
J. Chem. Educ. 41 ,488 (1964)
Spectra of solids gives structural information. Differences from solution absorptions show solvent interactions. Requires attachment to a good scanning spectrometer. Not designed as student experiment, but adaptable.

*PHYS ORG ACBA BIOCHEM KEQ UVIS 3

Determination of the Microscopic Ionization Constants of Cysteine
Clement, G. E.; Hartz, T. P.
J. Chem. Educ. 48 ,395 (1971)
Cysteine is a tri-functional amino acid. Ionization scheme given; seven ionization constants determined by a method combining acid-base titration and UVIS spectroscopy. Recording spectrophotometer preferred. Spec-20 OK. Assorted buffers needed.

*PHYS CALORIMETRY THERMO 2

Heat of Precipitation
Clever, L. H.
J. Chem. Educ. 38 ,470 (1961)
An Erlenmeyer flask in a 500-ml beaker with wadded up paper towels in the dead space is used as the calorimeter. Heat capacity of the calorimeter is det'd from the heat of neutralization (13.6 kcal/mole H^+). The heat of pptn of AgCl (and/or AgBr) is then det'd by mixing the reagents. Reader (DT) and bibliographers suggest use Ba^{++}/ $SO_4^=$ pptn - less expensive.

*PHYS APPARATUS DEMO DENSITY 3

A Demonstration Experiment on Partial Molar Volumes
Coch, J. A.; Lopes, V.
J. Chem. Educ. 47 ,270 (1970)
Specially designed volumetric flask used to find partial molar volume of trichloroacetic acid, aq. sol'n.

*PHYS DIPOLE GAS REFRACT VACTEK 4

Gas Phase Dipole Moment and Refractive Index Determinations: Two physical chemistry experiments
Coe, D. A.; Nibler, J. W.
J. Chem. Educ. 50 ,82 (1973)
Dipole moment by oscillator and freq. counter only. Refractive index using interferometer (construction details, or purchased). HCl, COS, CF4, etc.

*PHYS APPARATUS INSTR PROJ REFRACT 3

Construction of a Simple Refractometer: A chemical instrumentation experiment
Coe, G. R.; Conlon, R. D.; Dessy, R. E.
J. Chem. Educ. 41 ,337 (1964)
Requires photocell, Wheatstone bridge. Resistance vs. refractive index of standards used to prepare calibration curve. Some glassblowing.

*PHYS COLOR DENSITY 2

A First General Chemistry Laboratory Experiment
Cohen, S. H.; Zabel, D. E.; Shores, R. D.
J. Chem. Educ. 47 ,66 (1970)
Note describes an experiment on subjective (color, odor) vs. objective (density) properties. Caution: the description is somewhat sexist. (I think most women would resent the remarks made. CBA)

*PHYS DIPOLE GAS VACTEK 4

An Experiment on Dipole Moments and Polarizabilities of Gas Molecules
Cole, R. H.; Berberian, J. G.
J. Chem. Educ. 48 ,129 (1971)
Wayne-Kerr bridge and capacitance cells, gas-handling system, SF6, CHF3. Detailed calculations.

*PHYS APPARATUS PHASE VAPORPRESS 3

Method for the Determination of Liquid-Vapor Binary Equilibria
Colgate, S. O.; Hanrahan, R. J.
J. Chem. Educ. 41 ,433 (1964)
Apparatus for sampling, easily constructed.

*PHYS ELECTROCHEM 4

The Measurement of the Conductance of Electrolyte Solutions
A dc method.
Colton, R.; Sketchley, G. J.; Ritchie, I. M.
J. Chem. Educ. 53 ,130 (1976)
A straightforward method for measuring the absolute value of the conductance of an electrolyte solution. Based on a method described but not heretofore used in a teaching experiment. Conductance cell requires glassblowing.

*PHYS QUANTUM UVIS 2

The Spectrum of Atomic Hydrogen: A mass scale freshman laboratory experiment
Companion, A.; Schug, K.
J. Chem. Educ. 43 ,591 (1966)
Inexpensive student-built spectroscope (J. Chem. Educ. 39, 47(1962)) to measure H-spectrum, deduce Rydberg constant.

*PHYS DEMO DENSITY DIFFUSION LIQUID 2

Diffusion of Potassium Permanganate as a Lecture Demonstration
Conard, C. R.; Bent, H. E.
J. Chem. Educ. 46 ,758 (1969)
Short note describes use of a density gradient column to avoid convection currents in classical demo of ionic diffusion.

*PHYS ANAL CATALYSIS KIN 2

A Simple Kinetics Experiment: For General Chemistry Laboratory
Cone, W. H.; Hermens, R. H.
J. Chem. Educ. 40 ,421 (1963)
Silver ion catalyzed reaction of benzoic acid with S2O8(-2) ion, iodometric.

*PHYS APPARATUS KIN TECHNIQUE VACTEK 5

A Molecular Beam Apparatus for Student Experiments on Reactive Scattering
Conley, R. J.; Greene, E. F.; McInnis, S. M.
J. Chem. Educ. 51 ,620 (1974)
Specially built molecular beam measures scattered reactants and products. Interpretation is sophisticated. Potassium metal plus a collision beam of bromine or iodomethane as partner.

*PHYS DENSITY NOPROC REFRACT SURFACE VISC 3 HAZARD

The Measurements of Properties in Physical Chemistry
Coolidge, E. C.
J. Chem. Educ. 37 ,141 (1960)
Pedagogical. Student issued 1 unknown for determination of approx. 10 phys. properties and identification. List of possible unknowns given.
Hazard (avoidable): benzene.

*PHYS KIN UVIS 3

A Colorimetric Chemical Kinetics Experiment
Corsaro, G.
J. Chem. Educ. 41 ,48 (1964)
Reaction of crystal violet and NaOH followed spectrophotometrically. Ionic strength is a variable. Within capacity of many freshmen.

*PHYS ASSOC EDTA KSP SOLUB TITN 3

Ion Strength, Ion Association, and Solubility
Corsaro, G.
J. Chem. Educ. 39 ,622 (1962)
Sat'd CaSO4 in solutions of varying ionic strength. Solubility analyzed by EDTA titration for Ca ion, some theory and illustrative calculations.
Caution: ammonium perchlorate is a storage hazard.

*PHYS ORG CATALYSIS KIN MICELLE UVIS 3

Micelle Catalysis of an Aromatic Substitution Reaction
Cosaro, G.; Smith, J. K.
J. Chem. Educ. 53 ,589 (1976)
Iodination of aniline is catalyzed in sodium lauryl sulfate solution; this compound forms micelles with negatively charged pseudo surfaces. Iodine measured colorimetrically.

*PHYS ASSOC CATALYSIS COMPUTER KIN REDOX 4

Ion Association and Ionic Reaction Rates: An Investigation of The Bromoacetate-Thiosulfate Reaction
Cosgrove, R. K.; King, P. W.; Norris, A. C.
J. Chem. Educ. 48 ,626 (1971)
Measuring rate dependence on salt effect, third ion catalysis. Iodimetry. Sophisticated analysis.

*PHYS ANAL IONSELECT KEQ PH 3

Acid Dissociation Constant of the Ammonium Ion Using the Glass Electrode An Undergraduate Experiment
Covington, A. K.; Caudle, J.
J. Chem. Educ. 49 ,552 (1972)
Glass/ ammonium chloride, ammonia, MCl / AgCl / Ag, where MCl is a soluble chloride. pH meter.

*PHYS ANAL IONSELECT KEQ THERMO 3 4 HAZARD

The Dissociation Constant of HF: An Undergraduate Experiment with the Lanthanum Fluoride Ion-Selective Electrode
Covington, A. K.; Thain, J. M.
J. Chem. Educ. 49 ,554 (1972)
Polyethylene working equipment. LaF3 electrodes from Corning.
HAZARDS: Fluorides are highly toxic and NaF/HCl mixtures are corrosive.

*PHYS COMPUTER TECHNIQUE THERMO 4

Flame Temperature: A physical chemistry experiment
Craig, N. C.; Carlton, T. S.; Schoonmaker, R. C.
J. Chem. Educ. 51 ,54 (1974)
Measurement of methane-air flames by means of the sodium D-line reversal technique. L&N pyrometer. Local computer program for thermodynamic functions.

*PHYS ELECTROANAL KIN NOPROC 4

Kinetics from Polarography: An experiment for the teaching laboratory
Crooks, J. E.; Bulmer, R. S.
J. Chem. Educ. 45 ,725 (1968)
The height of a polarographic wave may be determined by the rate of a reaction. Rx studied is formaldehyde hydrate (irreducible) to formaldehyde (reducible) in aq. phosphate buffered soution. Much theoretical discussion; little experimental detail.

*PHYS APPARATUS ELECTROCHEM KIN NOPROC 2

A Stabilized Linear Direct Reading Conductance Apparatus: The solvolysis of t-butyl chloride
Cyr, T.; Prudhomme, J.; Zador, M.
J. Chem. Educ. 50 ,572 (1973)
Construction of sturdy lower-cost conductance equipment given. Expt. designed for first-year students. Worksheet given.

*PHYS IR QUANTUM 4

Potential Curves For The I2 Molecule: An undergraduate physical chemistry experiment
D'Alterio, R.; Mattson, R.; Harris, R.
J. Chem. Educ. 51 ,282 (1974)
Straightforward.

*PHYS APPARATUS NOPROC VAPORPRESS 3

Isopiestic Vapor Pressure Apparatus: A physical chemistry experiment
Dailey, G. W.; Huff, R. B.; Kang, J.; Queen, L. D.; Patterson, C. S.
J. Chem. Educ. 38 ,28 (1961)
Describes method and apparatus only. Glass vacuum desiccator, polystyrene float, silver dishes, etc.

*PHYS ERROR SURFACE UVIS 2

Adsorption Isotherm Using a Colorimetric Method: A general chemistry experiment
Dandy, A. J.
J. Chem. Educ. 41 ,47 (1964)
CuSO4 adsorbed on charcoal from water solutions of various concentrations. Cu determined spectrometrically by NH3. Freundlich isotherm plot. Evaluation of constants, and error analysis.

*PHYS GAS VACTEK 3

Determination of Compressibility Factor: An experiment for physical chemistry
Dannhauser, W.
J. Chem. Educ. 49 ,563 (1972)
Vac. and gas manifold. He, N2, CO2 (compressed gases). Gives measure of non-ideality, Van der Waals' constants, etc.

*PHYS ORG APPARATUS KIN 3

A Simple and Inexpensive Constant Temperature Bath: Its Use in an Undergraduate Kinetics Experiment
Dannley, R. L.; Friedman, L.
J. Chem. Educ. 53 ,265 (1976)
For temps. -81 to 100 deg. Celsius. Depends on refluxing liquids. 20 suggested safe refluxing liquids tabulated. Msmnt. of 1st order rates and activation energies for the hydrolysis of C3 to C6 omega-hydroxyalkyl chlorides by titration.

*PHYS APPARATUS DEMO GAS 2

Boyle's Law
Davenport, D. A.
J. Chem. Educ. 56 ,322 (1979)
Ultrasimple apparatus for effective demo based on hypodermic syringe and household scales.

*PHYS GAS THERMO VAPORPRESS 2

Experiments With Butane Lighter Fluid
Davenport, D. A.
J. Chem. Educ. 53 ,306 (1976)
1) Average molecular weight of butane fluid, 2) use of tire gauge to measure the vap. pressure as a function of temp, 3) molar heat of combustion, by measuring temp. rise in water.

*PHYS APPARATUS DIFFUSION GAS 2

Hypodermic Syringes in Quantitative Elementary Chemistry Experiments: 1. The gas laws
Davenport, D. A.
J. Chem. Educ. 39 ,252 (1961)
Thirty milliliter syringe demonstrates Boyle's, Charles' laws, Dalton's law of partial pressures and, with a specially constructed pierced plug, Graham's law of diffusion.

*PHYS ANAL APPARATUS DENSITY GAS KIN SOLUB VAPORPRESS 2

Hypodermic Syringes in Quantitative Elementary Chemistry Experiments 2. General Chemistry Experiments
Davenport, D. A.; Sava, A. N.
J. Chem. Educ. 39 ,617 (1962)
Techniques for studying gas densities, analysis of mixtures (by absorbents), solubilities of gases in liquids, liquefaction of gases, vapor pressures of liquids, rates of reaction (NaBH4 hydrolysis), NO2-N2O4 equilibrium.
See also Groetz and Gauerke (1971).

*PHYS ELECTROCHEM KEQ PH THERMO 3

The Determination of the pK of the Dihydrogen Phosphate Ion; A student experiment.
Davies, I. R.; Serjeant, E. P.; Warner, A. G.
J. Chem. Educ. 54 ,649 (1977)
Intended for Honors sophomores. Thermodynamic validity and accuracy of measurment are stressed.

*PHYS GRAVIM KIN 3 HAZARD

The Dissolution of Tin in Solutions of Iodine: A kinetic experiment
Davies, J. F.; Trotman-Dickenson, A. F.
J. Chem. Educ. 43 ,483 (1966)
Tin metal is suspended (thread) from balance arm, allowed to hang in I2/benzene solution of different concentrations. Rates are followed by changing weight. HAZARD: benzene (avoidable).

*PHYS APPARATUS SURFACE VACTEK 4

Gas-Solid Interactions: An experiment designed for undergraduate students
Davis, B. W.; Saban, G. H.; Moran, T. F.
J. Chem. Educ. 50 ,219 (1973)
Requires 12-18 hrs. N2 adsorption on carbon-black at 77 deg. K. BET theory.

*PHYS ORG CATALYSIS KIN NATPROD POLARIM 3

Acid-Catalyzed Hydrolysis of Sucrose: A student study of a reaction mechanism.
Dawber, J. G.; Brown, D. R.; Reed, R. A.
J. Chem. Educ. 43 ,34 (1966)
When carried out at varying acid concentrations, this well-known "pseudo-first order" reaction can be shown to be unimolecular. Hammett acidity function.

*PHYS ORG KIN NOPROC REFRACT TAUTOMERS THERMO 3

Keto-Enol Tautomerization: A Thermodynamic and Kinetic Study
Dawber, J. G.; Crane, M. M.
J. Chem. Educ. 44 ,150 (1967)
Report of data taken by students on rate and extent of enolization of acetoacetic ester and acetylacetone at different temperatures by enol bromination method. Molar refraction was not a satisfactory quantitative method.

*PHYS GAS 1 2 HAZARD

Ideal Gas Laws: Experiments for general chemistry
Deal, W. J.
J. Chem. Educ. 52 ,405 (1975)
Several modifications of simple experiments. For example, gas sample from lecture bottle is weighed at ambient T, P to calculate R.
HAZARD: protect students from exposure to liq. or vap. Hg.

*PHYS ELECTROANAL ELECTRODE 4 5

An Electrochemical Experiment Using an Optically Transparent Thin Layer Electrode.
DeAngelis, T. P.; Heineman, W. R.
J. Chem. Educ. 53 ,594 (1976)
Gold mesh-glass sandwich. Construction of electrode detailed and use in cyclic voltametry, coulometry, spectroelectrochemistry described. Descriptions soarse, but adequate for advanced course.

*PHYS DRYLAB QUANTUM RAMAN 4

Raman Spectra of ZYX3 Compounds: A dry-lab spectral analysis experiment
Dehaan, F. P.; Thibeault, J. C.; Ottensen, D. K.
J. Chem. Educ. 51 ,263 (1974)
Raman spectra of two molecules given. Elucidation requires group theory and prediction of all spectra of all configurations.

*PHYS ANAL COORD CRYO ERROR STOICH TITN 3

Cryoscopic Measurement of the Coordination Number of Copper(II)
DeLorenzo, H. C.; Frugoni, J. A. C.; Lopez, V.
J. Chem. Educ. 46 ,113 (1969)
F. pt. depression of aq. copper ammine sulfate gives coord. number. NH3 analysis by acid tit'n; copper by iodimetry.

*PHYS APPARATUS HITEMP HPRESS KIN VACTEK 3

Kinetics of The Gas Phase Pyrolysis of 1,1-Dichloroethane: A physical chemistry experiment
Demare, G. R.; Goldfinger, P.; Huybrechts, G.; Olbregts, J.; Toth, M.
J. Chem. Educ. 46 ,684 (1969)
Rates followed by pressure increase to approx. 100 torr, 400-460 deg. C.

*PHYS FLUOR KIN LUMIN 3

Luminescence Spectroscopy and Bimolecular Quenching: A physical chemistry experiment
Demas, J. N.
J. Chem. Educ. 52 ,677 (1975)
Absorption, excitation and emission spectra and kinetics of quenching of bright orange luminescence of tris-(2,2'-bipyridine)ruthenium chloride by K4Fe(CN)6. Other quenching reagents can be followed visually or instrumentally. Requires spectrofluorimeter.

*PHYS APPARATUS FASTREACTION KIN LUMIN 4

Luminescence Decay Times and Bimolecular Quenching: An Ultrafast Kinetics Experiment.
Demas, J. N.
J. Chem. Educ. 53 ,657 (1976)
Detn of decay time of tris(2,2'-bipyridine)ruthenium(II) ion in oxygenated and deoxygenated water. Mean lifetime approx. 600 nanoseconds. Flash lamp firing circuit schematic and sketch given. Oscilloscope. Could use pulsed N2 laser. Good discussion.

*PHYS CATALYSIS DEMO KIN LUMIN OSC.RXN 2 3

An Oscillating chemical reaction with a luminescent indicator
Oemas, J. N.; Diemente, D.
J. Chem. Educ. 50 ,357 (1973)
Ru(bipy)3Cl2 (luminescent), malonic acid, KBrO3, H2SO4. color cycle visualized by UV in darkened room.

*PHYS AVOGADRO 1

Size of a Molecule - or What's in a Shape?
Demchik, M. J.; Demchik, V. C.
J. Chem. Educ. 48 ,770 (1971)
In a variation on the classic experiment for the determination of Avogadro's number from the height of an oil film, the water layer is acidified causing the molecules to tip over. Thus when the water layer is acid, the height of the film is the cross-sectional diameter of the molecules.

*PHYS DIFFUSION UVIS 3

A Quantitative Diffusion Experiment for Students
OePaz, M.
J. Chem. Educ. 46 ,784 (1969)
Permanganate diffuses from one end into 2 mm tube filled with water. Colorimetric measurement at various heights and times. Discussion of errors.

*PHYS CRYO DENSITY TECHNIQUE 4

Flow Densimetry: A Simple Analytical Technique for Activity Measurements by Freezing Point Data
Desnoyers, J. E.; Ostiguy, C.; Perron, G.
J. Chem. Educ. 55 ,137 (1978)
Commercial flow densimeter, quartz thermometer. Not described as a student experiment, but could be adapted.

*PHYS MAGNETIC NMR 3

The Determination of Paramagnetic Susceptibility by NMR: A physical chemistry experiment
Deutsch, J. L.; Poling, S. M.
J. Chem. Educ. 46 ,167 (1969)
Iron in two oxidation states, complexed and uncomplexed, influences bulk magnetic suscept. and thus proton shifts of an inert substance (t-butyl alcohol). Temp. variation also. Coaxial nmr tubes.

*PHYS DEMO ENVIRON SURFACE 2

Removal of Crude Oil from Marine Surfaces: An ecological lecture experiment
Dieteren, H. M. L.; Schouteten, A. P. H.
J. Chem. Educ. 49 ,19 (1972)
One method is to sink the oil by spraying it with sand treated with a surfactant. Demo investigates effect of amine surfactant at various concentrations, pH, etc

*PHYS DEMO ELECTROCHEM SOLAR 1

Electroplating With Solar Energy
Dix, G. F.; Hultsch, R. A.
J. Chem. Educ. 55 ,259 (1978)
Three commercial 0.5V silicon solar cells used to plate a nail with nickel. Monitor current and time.

*PHYS DEMO ELECTROCHEM OSMOSIS SURFACE 3

Electro-Osmosis as a Demonstration Experiment: Coupled irreversible effects and direct energy conversion
Dixon, J. R.; Schafer, F. W.
J. Chem. Educ. 43 ,380 (1966)
Requires sensitive DC volt-ammeter, otherwise simple. Good student project.

*PHYS INORG COMPUTER INTEGR KIN ORGANOMETAL 4 HAZARD

The Kinetics and Mechanism of a Metal Carbonyl Substitution Reaction
Dobson, G. R.; Paxson, J. R.
J. Chem. Educ. 49 ,67 (1972)
Prepn (2,5-dithiahexane)tetracarbonylchromium(0) and molybdenum(0) analogue, and kinetics of reaction with triethylphosphite. Spec-20. Air-sensitive, work under N2 (app.described). NMR,MASSPEC,IR,UVIS, parameters given. Explicit exptl details. HAZARD: toxic compounds

*PHYS APPARATUS HITEMP KEQ 5

Estimating The Ionization Constants of 4-Chloro-2,6-Dinitro Phenol; High Temperature Spectrophotometric Cell
Dobson, J. V.
J. Chem. Educ. 48 ,697 (1971)
Equipment designed to allow determination of ionization constants of weak acids and bases to 200 deg. C. and 1000 psi.

*PHYS HEAT MASSPEC THERMO 4

The Bond Energy of CH3-H: A Physical Chemistry Experiment
Dorain, P. B.
J. Chem. Educ. 56 ,622 (1979)
Varian EM 600 mass spectrometer. Appearance potentials of ethyl cation derived from ethane, and from propane measured. Given heats of formation of reacting and product species, dissociation energy of the CH3-H bond is easily calculated.

*PHYS APPARATUS GAS VACTEK 2 HAZARD

A Simple Vacuum System
Dorfman, M. K.; Kokes, R. J.; Mathia, T.
J. Chem. Educ. 39 ,20 (1962)
Simple vacuum manifold described for use in Gen. Chem. Lab. - Boyle's Law, m.wt. det'n, etc. HAZARD: calibrate with something other than benzene - carcinogen.

*PHYS ORG COORD KEQ KIN UVIS 3

A Spectrometric Study of The Oxidation of Alcohols by Cerium(IV)
Doyle, M. P.
J. Chem. Educ. 51 ,131 (1974)
To establish mechanism, measure Keq for complex formation (one lab period) and kinetics of complex decomposition (groups, one additional period).

*PHYS CATALYSIS DEMO KIN REDOX 2

Autocatalysis
Dreisbach, D. A.
J. Chem. Educ. 35 ,A29 (1958)
Reaction of KMnO4 with oxalic acid is catalyzed by Mn^{++} ions.
A Chem-Ed Tested Demo.

*PHYS APPARATUS COMPUTER ERROR FLUOR KIN LASER QUANTUM VACTEK 4 5

Quenching of I2 Vapor Fluorescence Excited With He-Ne Laser Light: A kinetics-spectroscopy experiment
Duchin, K. L.; Lee, Y. S.; Mills, J. W.
J. Chem. Educ. 50 ,858 (1973)
Requires laser, photomultiplier tubes, all Teflon, Hg-free vacuum syst. with high volt. power supply, recording electrometer. Stern-Volmer kinetics for self-quenching. Project: foreign gas quenching, fluorescence polarization study.

*PHYS ORG ACBA KIN NOPROC PREP TITN 3

Kinetic Studies of The Solvolysis of Two Organic Halides: A laboratory project
Duncan, J. A , Pasto, D. J.
J. Chem. Educ. 52 ,666 (1975)
Rates of solvolysis of 2-chloro-2-methylpropane and 3-chloro-3-methyl-1-butyne (prep. given) in 80% ethanol-water. Effect of temp, salt, base. Followed by titration. Needs three 4-hr. periods. Lab report form given.

*PHYS NOPROC SURFACE 4

Surface Area of Activated Charcoal by Langmuir Adsorption Isotherm
Dunicz, B. L.
J. Chem. Educ. 38 ,357 (1961)
Not an experiment. Modification of data treatment to find specific adsorption area.

*PHYS APPARATUS CALORIMETRY 3

Water Equivalent of Vacuum Flask Calorimeter by the Ice Fusion Method
Dunicz, B. L.
J. Chem. Educ. 37 ,635 (1960)
Straightforward, Dewar flask calorimeter.

*PHYS CRYSTAL MICROSCOPE NOPROC UVIS 4

Measurement of the Order Parameter in a Room Temperature Liquid Crystal: An Experiment for the Physical Chemistry Laboratory
DuPre, D. B.; Chapoy, L. L.
J. Chem. Educ. 56 ,759 (1979)
Detn of degree of orientational order at room temp; order disappears at higher temp. Detn of dichroic ratios. p-Methoxybenzylidene-p'-N-butylaniline (commonly called MBBA). Spectrophotometer. Polarizing microscope.

*PHYS DEMO PHASE 2

Lecture Demonstration of Vanishing Meniscus in Vapor-Liquid Transition
Duus, H. C.
J. Chem. Educ. 56 ,614 (1979)
Detailed description of construction and filling of glass containing tube. Liquid propane.

*PHYS CLOCK DEMO KIN 2

A Versatile Clock Reaction
Dye, J. L.
J. Chem. Educ. 37 ,A22 (1960)
Sodium persulfate/potassium iodide in a standard iodine-clock exp't, converted to a demo. Cu^{++} is added to a "control" sample to observe change in kinetics. No explanations - just directions for preparation of the solutions.

*PHYS APPARATUS CRYO DECAY PHOSPHOR 4 HAZARD

An Undergraduate Experiment For The Measurement of Phosphorescence Lifetimes
Dyke, T. R.; Muenter, J. S.
J. Chem. Educ. 52 ,251 (1975)
Requires strobe lamp, filters, photomultipliers, oscilloscope. Measurements on biacetyl, halogenated naphthalenes. Some exp'ts in EPA glass at liq. N2 temp. HAZARD: benzene used as a solvent is carcinogenic.

*PHYS AA KSP TECHNIQUE 4

The Solubility Curves for Calcium and Strontium Sulfates
Dyrssen, D.; Ivanova, E.; Aren, K.
J. Chem. Educ. 46 ,252 (1969)
A Bronsted saturator is a simple apparatus to give equilibrium solubility of solids in a flame system. Analysis by atomic absorption for Ca, Sr, Na. The effect of ion pairing causing deviation makes the calculations not trivial. Constant temp.

*PHYS INORG APPARATUS DEMO MAGNETIC 2

An Inexpensive, Convenient Demonstration of Magnetic Susceptibility
Eaton, S. S.; Eaton, G. R.
J. Chem. Educ. 56 ,170 (1979)
Construction of an inexpensive, small magnetic balance similar to a Gouy balance described but measuring the weight change of a small, powerful magnet on the balance pan with fixed sample between poles. Uses Hitachi-Hicorex magnets. (ie, the small strong ones you can get from Edmund Scientific).

*PHYS CALORIMETRY DEMO ELECTROCHEM THERMO 2

Two Lecture Experiments in Elementary Thermodynamics
Eberhardt, W. H.
J. Chem. Educ. 47 ,362 (1970)
(1) Heat of vaporization of methylene chloride by calorimetry (apparatus described); (2) voltage of an electrochemical cell constructed from two half cells; A. (Ag/0.2F Ag^{+}), and B. (Cu/0.2F Cu^{++}), so as to show reversible and irreversible processes.

*PHYS DEMO ELECTROCHEM 2

Electrolysis: H2O2 and H2O
Eberhardt, W. H.
J. Chem. Educ. 41 ,A59 (1964)
Hoffman electrolysis apparatus required. H2SO4 containing 3%H2O2 gives less H2 than H2SO4 solutions. A Chem-Ed Tested Demo.

*PHYS DEMO THERMO 2

Concerning Equilibrium, Free Energy Changes, LeChatelier's Principle II.
Eberhardt, W. H.
J. Chem. Educ. 41 ,A59 (1964)
Pink-blue cobalt solutions. A Chem-Ed Tested Demo.

*PHYS COORD KIN NOPROC REDOX UVIS 2

The Reactions of Ferroin Complexes: A Color-to-Colorless Freshman Kinetic Experiment
Edwards, J. O.; Edwards, K.; Palma, J.
J. Chem. Educ. 52 ,408 (1975)
Student is to follow rate of disappearance of ferrous o-phenanthroline on reaction with various reagents (acid, cupric, pyrophosphate, peroxydi-phosphate, etc.), also ferrous 5-nitrophenanthroline and bipyridyl complexes, spectrophotometrically.

*PHYS DEMO PHASE VAPORPRESS 2

Raoult's Law and Vapor Pressure Measurement
Egen, N.; Ford, P. C.
J. Chem. Educ. 53 ,303 (1976)
Mercury column-meter stick expt. Ether, ether-toluene mixture. Compare calculated v.p. to measured. A tested demonstration. Caution: Hg vapor.

*PHYS ACBA FLUOR UVIS 3

Excited-State Dissociation: Laboratory exercise using fluorescence
Ellis, D. W.
J. Chem. Educ. 43 ,259 (1966)
Acidities of phenols and ammonium salts greater in excited states. Measure absorption at uv and vis. maxima and also with exciting radiation in a filter fluorometer.

*PHYS ORG ACBA DISTRIB PHASE TITN 3 HAZARD

Simultaneous Equilibria in the Benzoic Acid-Benzene-Water System : A distribution experiment
Ellison, H. R.
J. Chem. Educ. 48 ,124 (1971)
System is characterized by 3 equilibria, (1) distribution of benzoic acid between benzene and water, (2) ionization of benzoic acid in aq. phase, (3) dimerization of acid in benzene phase. Titrations with NaOH used to find relevant constants. HAZARD : benzene is carcinogen - maybe toluene would be satisfactory.

*PHYS COMPUTER CRYO PHASE THERMO 3

Binary Solid-Liquid Equilibria
Ellison, H. R.
J. Chem. Educ. 55 ,406 (1978)
The naphthalene, p-dichlorobenzene system is used to find enthalpy of solution and freezing point lowering constants.

*PHYS ANAL IONSELECT KEQ 3

Ion Association: Ion-Selective Electrode Experiment
Emara, M. M.; Farid, N. A.; Lin, C. T.
J. Chem. Educ. 56 ,620 (1979)
Commercially available solid state selective electrode and pH meter used to determine the stability constants of sodium sulfate in aq. solution at varying ionic strengths.

*PHYS DEMO NOPROC PHASE PREP REDOX THERMO 2

Aluminothermic Reduction : An illustrative experiment
Espelund, A. W.
J. Chem. Educ. 52 ,400 (1975)
Procedure is well-described but not given explicitly. Detailed discussion of thermodynamics and phase diagrams, (1) simple charge (Fe_3O_4 + Al), and (2) slag-containing charge (Fe_3O_4 + Al + CaO). Caution: high temperatures and explosive potential.

*PHYS DEMO ELECTROCHEM SOLAR 1

A Simple and Inexpensive Solar Energy Experiment
Evans, J. H.; Pedersen, L. G.
J. Chem. Educ. 56 ,339 (1979)
Measured amounts of hydrogen gas are generated electrochemically and measured amounts of water pumped thru a vertical distance to measure power vs. load of a solar panel.

*PHYS ELECTROCHEM 2

Verification of The Form of The Nernst Equation: An experiment for introductory chemistry
Evans, J. S.
J. Chem. Educ. 45 ,532 (1968)
Ag/Ag(I)//Fe(II), Fe(III)/Pt used to measure concentration dependence of voltage, to establish form of equation. Salt bridge is KNO_3-wet filter paper. Requires high-impedence voltmeter.

*PHYS APPARATUS DIFFUSION GAS TRANSPORT 3

Graham's Laws: Simple Demonstrations of Gases in Motion Part II. Experiments
Evans, R. B.; III, Love, L. D.; Mason, E. A.
J. Chem. Educ. 46 ,423 (1969)
Open-ended. Requires some special glass-blowing. Easy calculations. Transport properties. Diffusion. Permeability.

*PHYS MASSPEC 4

Appearance Potential Measurements by Mass Spectrometry: A physical chemistry experiment
Fass, R. A.; Kendall, S. G.
J. Chem. Educ. 48 ,545 (1971)
One 6-hr. lab; small groups of students, methane-argon samples, Perkin-Elmer RMO-6D, and a trained technician.

*PHYS APPARATUS VAPORPRESS 3

Measurement of Vapor Pressure: A Gas Saturation Method
Feighan, J. A.
J. Chem. Educ. 37 ,149 (1960)
VP of water, common alcohols. N_2 carrier bubbled through liquids at various rates. Sintered glass gas dispersion unit. Vapor absorbed, or condensed and weighed.

*PHYS GAS 1

A Dalton's Law Experiment For Students in The Health Sciences
Feigl, D. M.
J. Chem. Educ. 51 ,273 (1974)
Measurement of CO2 pressure in inhaled and exhaled air by pressure drop when CO2 absorbed in 10% NaOH. Simple apparatus.

*PHYS APPARATUS DEMO ELECTROCHEM FUEL.CELL 2

The Electrolysis of Water - Fuel Cell Reaction
Feinstein, H. I.; Gale, V.
J. Chem. Educ. 54 ,432 (1977)
Inexpensive apparatus. Illustrates the electrolysis of water and its reverse (fuel cell) reaction. A tested demonstration.

*PHYS PHASE 1 2 HAZARD

Evaporation Rate: A beginning chemistry experiment
Feinstein, H. I.; Walters, C.
J. Chem. Educ. 49 ,135 (1972)
A short note on a simple beginning experiment. HAZARD: suggested solvents include CHCl3, benzene (carcinogens, avoidable).

*PHYS INORG DEMO KIN 2

Chemical Kinetics: The Effect of Surface Area on Reaction Rate
Felice, M. S.; Freirlich, M. B.
J. Chem. Educ. 55 ,34 (1978)
"Eyeball" comparison of rates of reaction of (1) I3- with mossy or granulated tin; (2) MnO4- with Fe filings or Fe wire; (3) HNO3 with Cu powder or Cu wire.

*PHYS ANAL ACBA DEMO KEQ PH 2

Buffer Action with Precise pH Monitoring
Felty, W. L.
J. Chem. Educ. 53 ,229 (1976)
Digital pH meter measures pH of various mixtures of acetates, phosphates, acid, etc.

*PHYS CATALYSIS DEMO KIN OSC.RXN 2

A Reaction Periodic in Time and Space: A lecture demonstration
Field, R. J.
J. Chem. Educ. 49 ,308 (1972)
Ce(IV)-Ce(III), malonic acid, KBrO3, H2SO4, ferroin (Belousov Reaction). Detailed discussion of autocatalytic reactions and oscillating systems.

*PHYS INORG CATALYSIS DEMO KIN OSC.RXN REDOX 2

Travelling Waves of Chemical Activity in the Zalkin-Zhabotinskii-Winfree Reagent
Field, R. J.; Winfree, A. T.
J. Chem. Educ. 56 ,754 (1979)
Oscillating reaction. Reaction of ferroin with malonic acid in the presence of a surfactant oscillates. Apparatus to show "waves" described, using overhead projector.

*PHYS KIN REDOX TITN 2 HAZARD

Oxidation of Ethanol by Chromium(VI) : A kinetics experiment for freshmen
Finlayson, M. E.; Lee, D. G.
J. Chem. Educ. 48 ,473 (1971)
Explicit directions. H2CrO4 conc. followed by titn. Na2S2O3. HAZARDS: Chromic acid is on OSHA list of carcinogens; highly exothermic reaction.

*PHYS ANAL COORD KSP PROJ SOLUB 3

Student Research Experiment With Multiple Equilibria
Fleck, G. M.
J. Chem. Educ. 42 ,106 (1965)
Student designed approaches to the lead-lead chloride solubility equilibria (complex ions involved). Caution: Pb is an embryotoxin.

*PHYS DEMO PHASE SVEX 2 HAZARD

A Visual Demonstration of Preferential Absorption
Folster, H. G.
J. Chem. Educ. 49 ,322 (1972)
Note on an elementary demo for stage separations course. HAZARDS: (1) Shield blender contents from sparks. (Fire). (2) CCl4 is a suspected carcinogen.

*PHYS COMPUTER IR MOL.SPECT PROJ QUANTUM VACTEK 4

Determination of The Vibrational Constants of Some Diatomic Molecules: A Combined Infrared Spectroscopic and Quantum Chemical 3rd yr. Chemistry Proj.
Ford, T. A.
J. Chem. Educ. 56 ,57 (1979)
Advanced molecular spectroscopy. Absolute intensities, as well as high high-resolution ir spectra. Uses standard gas cell, HCl, HBr, CO, NO. Ten 3-hr lab periods.

*PHYS ACBA NATPROD PH 0

Plant Pigments as Acid-Base Indicators. An Exercise for Junior High School
Forster, M.
J. Chem. Educ. 55 ,107 (1978)
Straightforward. Anthocyanin pigments extracted from leaves (e.g. red cabbage) with hot water. Various household acids, bases used to show color changes.

*PHYS ANAL ACBA KEQ UVIS 2

Colorimetric Determination of the Dissociation Constant of Acetic Acid
Forst, W.
J. Chem. Educ. 36 ,298 (1959)
The color of a methyl orange solution is used as a measure of hydrogen ion concentration. Spec-20.

*PHYS CATALYSIS KIN POLARIM 3

Determination of Catalytic Coefficient For a First-Order Reaction: An undergraduate physical chemistry experiment
Fraga, E. R.; Schifino, J.; Gomez, I.
J. Chem. Educ. 52 ,749 (1975)
Hydrolysis of sucrose followed with a polarimeter at low acid conc.; "catalytic coefficient" is dependence on H(+) conc. See also Dawber, et al, J. Chem. Educ. 43, 34 (1966).

*PHYS ASSOC COLLOID MICELLE 3

A Simple Experiment Illustrating the Structure of Association Colloids
Friberg, S.; Bendikson, B.
J. Chem. Educ. 56 ,553 (1979)
Sodium dodecyl sulfate (a surfactant) solutions are treated with (1) octane, and (2) pentanol, added in small increments. After each addition the solutions are tested for transparency, behavior in polarized light, electrical conductance. Micelle formation and solublization of some octane and much pentanol are noted. also inverse micelle formation.

*PHYS DEMO PHASE 1 2

Le Chatelier's Principle: A Laboratory Exercise
Friedman, F.
J. Chem. Educ. 54 ,236 (1977)
Chem.Ed. Compact. Showing how water can boil below 100 deg. Celsius. Simple apparatus.

*PHYS CALORIMETRY THERMO 2

Hydrogen Bonding And Heat of Solution
Friedman, N.
J. Chem. Educ. 54 ,248 (1977)
Temperature rise and (with some refinements) heat of solution of ethanol, dimethylsulfoxide and dimethylformamide. Student calorimeter. Caution: DMSO absorbs thru skin, carrying in contaminants.

*PHYS INORG DEMO ELECTROCHEM 2

Electrode Potentials With a Vacuum Tube Voltmeter
Gachis, L.
J. Chem. Educ. 38 ,A63 (1961)
Half-cells are constructed by slashing a filter paper circle into quadrants. On each, a splotch of met. ion sol'n (eg, CuSO4) serves as the electrolyte, a small piece of the metal (eg, Cu) serves as the active electrode, and a splotch of an inert electrolyte in the cent. of the filter, joining the met. ion sol'ns, serves as the salt bridge. Poten. bet. the half-cells are meas. with any voltmeter; we use a pH meter (+/-MV) at SUSB. Chem-Ed Tested Demo.

*PHYS DEMO LUMIN REDOX 2 HAZARD

Chemiluminescence: An illuminating experiment
Gafney, H. D.; Adamson, A. W.
J. Chem. Educ. 52 ,480 (1975)
Direct addition of Ru(bipy)2+++, prepared by PbO2 oxidation of Ru(bipy)2Cl2, to NaBH4 solution produces a bright orange flash. Apparatus described for using this reaction as a demonstration. HAZARD: foaming (due to hydrogen evolution?), exothermic.

*PHYS KIN SOLID VACTEK 4

Thermal Decomposition of KMnO4: A high vacuum experiment for students
Galwey, A. K.
J. Chem. Educ. 37 ,98 (1960)
Final-year Honors. Glassblowing, furnace (250 deg. C.). Measurepressure of product gases. Caution: use a safety shield. Samples are explosive.

*PHYS SURFACE TECHNIQUE UVIS 3

Bubble Fractionation: A physical chemistry experiment
Garmendia, A. A.; Perez, D. L.; Katz, M.
J. Chem. Educ. 50 ,864 (1973)
A stage separations experiment. N2, crystal violet solution, soap film flowmeter. Process is followed colorimetrically; surface tension also measured.

*PHYS ORG KIN NMR QUANTUM STEREO 3

NMR Determination of The Rotational Barrier in N,N-Dimethylacetamide: A physical chemistry experiment
Gasparro, F. P.; Kolodny, N. H.
J. Chem. Educ. 54 ,258 (1977)
Variable-temperature probe NMR. Variation in line shape measured as function of temperature (259-368 K). Theory of line shape analysis. Rate of exchange also calculated.

*PHYS IR .KIN 4

Infrared Spectrometry to Study Second Order Kinetics
Gastambide, B.; Blanc, J.; Allamagny, Y.
J. Chem. Educ. 41 ,613 (1964)
Reaction of phenyl isocyanate with menthol is followed by quantitative infrared spectroscopy. Liquid samples. Caution: phenyl isocyanate is a lachrymator,an irritant, possibly a carcinogen.

*PHYS COLORIM KIN 2

A Simple General Chemistry Kinetics Experiment
Gellender, M.
J. Chem. Educ. 52 ,806 (1975)
Iodide-persulfate. Not a clock exp't. Reaction is followed colorimetrically by observing brown color of triiodide.

*PHYS MOL.SPECT QUANTUM UVIS 2 3

A Molecular Spectral Coroboration of Elementary Operator Quantum Mechanics
Gerkin, R. E.
J. Chem. Educ. 42 ,490 (1965)
Measured absorption maxima of a series of polymethine dyes compared with quantum theory calculations of transition energies based on free electron theory (particle in one-dimensional box). Freshman honors at Ohio State- or higher level.

*PHYS GAS KEQ KIN VAPORPRESS 2

Capillary Tube Experiments For Introductory Chemistry Laboratory
Gesser, H. D.; Lithown, C.; Brattston, D.; Thompson, I.
J. Chem. Educ. 44 ,387 (1967)
Inexpensive. Designed for large classes. Uniform capillary with Hg-drop plug (piston) in tubing used to measure vap. pressure common alcohols; Keq ammonium carbamate decomp.; kinetics decomp. benzenediazonium chloride.

*PHYS ELECTROCHEM SOLID 2 3

An Inexpensive Experiment on Semiconductors
Getzin, D. R.
J. Chem. Educ. 48 ,541 (1971)
Inexpensive experiment for first-year course. Resistance measurements on a small doped germanium bar, temperature coefficients, for N type determination.

*PHYS ORG BIOCHEM CHIRAL ISOMERS KEQ POLARIM 2

A Polarimeter Experiment for Introductory Courses
Gibas, M. A.
J. Chem. Educ. 53 ,462 (1976)
Purpose of experiment is to determine the eq. constant for the reaction: alpha-D-glucose = beta-D-glucose by measuring the rotation of solutions of diff. conc. Details by writing.

*PHYS NOPROC PHASE 4

Variation of Azeotropic Composition and Temperature with Pressure: An undergraduate physical chemistry experiment
Gibbard, H. F.; Emptage, M. R.
J. Chem. Educ. 52 ,673 (1975)
Theory of azeotropes reviewed and detailed mathematical interpretation of an experiment from Daniels, Exp'l Phys. Chem. (by citation only).

*PHYS APPARATUS HITEMP PHASE TECHNIQUE 4

A Versatile Hot Stage Microscope:
Lab studies in high temperature chemistry
Glasser, L.; Miller, R. P.
J. Chem. Educ. 42 ,91 (1965)
Construction and application to phase transition and binary system phase diagrams to 1750 deg. C.

*PHYS ORG CATALYSIS COMPUTER GC ISOMERS KIN NMR 3

Amine-Catalyzed Isomerization of Diethyl maleate to Diethyl fumarate
Glover, I. T.; Cushing, G. W.; Windsor, C. M.
J. Chem. Educ. 55 ,812 (1978)
Catalyst conc. and temp. varied. Analysis by gc peak height or nmr integration.

*PHYS DEMO THERMO 1

Heat of Crystallization
Goeders, C N
J Chem Educ. 37 ,A79 (1960)
A Chem-Ed Tested Demo. Unusual, "hands-on" demo: cold, supersaturated Na2S2O3 solutions are given to the students. They must induce crystallization using a stirring rod. Test tubes become hot to the touch.

*PHYS COORD ELECTROANAL KEQ 4 HAZARD

Formation Constants of a Metal-Anionic Ligand System in Dioxane-Water
Goldberg, D. E.
J. Chem. Educ. 40 ,341 (1963)
Pot. tit'n, high pH, glass electrode, activity coefficients. Divalent Cu, Ni complexes with (eg) acetylacetone in dioxane. Titration with tetramethylammonium hydroxide. Sample calculations. HAZARD: dioxane is a carcinogen.

*PHYS ASSOC DEMO 1

Ionic Versus Covalent Bonding
Goldish, D. M.
J. Chem. Educ. 46 ,A49 (1969)
Simple comparisons of the bonding in chlorine-containing compounds by testing with AgNO3. A Chem-Ed Tested Demonstration.

*PHYS KIN SOLID VACTEK 3

Kinetics of the Thermal Decomposition of Silver Permanganate: A solid state chemistry experiment
Goldstein, M. K.; Flanagan, T. B.
J. Chem. Educ. 41 ,276 (1964)
Straightforward. Intended to teach use of vacuum systems. AgMnO4 was chosen because of low decomp. temperature. Typical decomp. curves given, Arrhenius plot. Two or three periods. Extensions suggested.

*PHYS APPARATUS COORD FASTREACTION FLASHPHOTOL KIN 4

Relaxation Kinetics of Ferric Thiocyanate: A temperature-jump and flash-photolysis study
Goodall, D. M.; Harrison, P. W.; Hardy, M. J.; Kirk, C. J.
J. Chem. Educ. 49 ,675 (1972)
Flash photolysis apparatus described earlier. Circuit diagram for temperature-jump given. Extensions possible.

*PHYS ANAL KSP 1 2

Is The Solubility Product Costant? Introductory experiment in solubility equilibrium
Goodman, R. C.; Petrucci, R. H.
J. Chem. Educ. 42 ,104 (1965)
PbI2 formed from lead nitrate and potassium iodide of varying conc. gives effect of ion conc. on Ksp. Extensions to effect of complex formation.

*PHYS APPARATUS PHASE SURFACE 3 HAZARD

A Micromethod For Measuring Interfacial Tension
Gordieyeff, V. A.; Hackley, E. B.
J. Chem. Educ. 37 ,301 (1960)
Mod. of capillary method measuring pressure above capillary eliminates uniform capillary. Temp. control. Water-organics, as xylene, oleic acid, etc. HAZARD: avoid the benzene.

*PHYS ELECTROCHEM NOPROC 2 HAZARD

Some Electrochemical Experiments for Freshmen
Gorman, M.
J. Chem. Educ. 34 ,409 (1957)
An experiment is described wherein a student identifies the metal of a (1M Cd^{++}, Cd) couple, given as an unknown, by constructing a series of cells using it as one half-cell and a series of known half-cells, such as the (1M Cu^{++}, Cu) couple, as the other. Identification is made by obs. the cell voltage and calc. the SRP of the Cd^{++}/Cd couple. HAZARD: Cd, extr. toxic.

*PHYS POLYMER CONSUMERPROD ELECTROCHEM REDOX 2 HAZARD

The Electroplating of Polyethylene
Gorodetsky, Malka
J. Chem. Educ. 55 ,66 (1978)
Polymer film oxidized by chromic acid sensitized by Sn(II), then Pd(II), with Cu(0) plated on the polyethylene from a Cu(II) solution and formaldehyde as the reducing agent.
HAZARD: Chromium is potential carcinogen; possibly HNO3 as cleaning agent.

*PHYS DIFFUSION GAS GC 4

Diffusion of Gases: A physical chemistry experiment
Gover, T. A.
J. Chem. Educ. 44 ,409 (1967)
Special diffusion tube, analysis by GC. Complex theory.

*PHYS APPARATUS ELECTROCHEM KIN 3

Reaction Kinetics From Conductivity Data: An apparatus for the student laboratory
Greenberg, D. B.
J. Chem. Educ. 39 ,140 (1962)
Inexpensive specially designed conductivity apparatus; circuit diagram. Rate of decomp. of acetic anhydride in water-ethanol. Caution: Ac2O causes burns.

*PHYS ORG ACBA KEQ NOPROC SEPARATION 2

Effect of Amine Structure on the Relative Acidity of Conjugate Acids
Griswold, R. E.
J. Chem. Educ. 42 ,483 (1965)
Student purifies sample of an alicyclic or aryl amine by distillation; det'ns pKa by method of half-neutralization using a pH meter. Aniline is used as a standard amine.

*PHYS COMPUTER DRYLAB KIN 3 4

Analog Computer Simulation
Griswold, R.; Haugh, J. F.
J. Chem. Educ. 45 ,576 (1968)
Heathkit analog computer programmed by instructor for three step mechanism k1, k-1, k2. Students adjust initial conc., k values, plot output and calculate.

*PHYS DEMO REDOX 2 HAZARD

Oxidation and Chemical Environment
Grotz, L. C.
J. Chem. Educ. 54 ,618 (1977)
Ability of Fe+3 to oxidize iodide is inhibited by fluoride ion. Removal of fluoride (as HF) restores oxidizing ability. HAZARD: fluorides in concentrations suggested in this article are toxic; HF is a serious toxic and blister-producing gas.

*PHYS APPARATUS GAS 2

Boyle's Law With Plastic Syringes
Grotz, L. C.; Gauerke, J. E.
J Chem. Educ. 48 ,337 (1971)
Reports successful use of disposable syringes to replace glass syringes in method of Davenport (1962).

*PHYS ANAL COORD KEQ TITN 3

Stepwise Formation Constants of Complex Ions: A student experiment
Guenther, W. B.
J. Chem. Educ. 44 ,46 (1967)
Ammine complexes of Ni(II), Ag(I), Zn(II), etc. by pH.

*PHYS KIN VACTEK 3

Kinetics of The Gas Phase Decomposition of Di-Tert-Butyl Peroxide
Guillory, W. A.
J. Chem. Educ. 44 ,514 (1967)
Requires previous preparation of di-tert-butyl peroxide (ref.). First order. Constant volume system, followed by pressure increase. 2-3 hours.

*PHYS APPARATUS CRYO GAS IR QUANTUM 4

The Infrared Spectra of Gases at 300 deg K and of Frozen Films at 77 deg K: A physical chemistry experiment
Guillory, W. A.
J. Chem. Educ. 46 ,681 (1969)
N2O, SO2, CH2Cl2, CO2. Modified Hornig-type gas cell.

*PHYS KIN UVIS 2 3

The Tin(II)-Methyl Orange Reaction: A kinetics experiment for introductory chemistry
Haight, G. P., Jr.
J. Chem. Educ. 42 ,478 (1965)
Stoichiometry is 2 tin to 1 MO. Kinetics are first order in each reagent and in H+. Air oxidation and tin(II)-chloride complexation make for serious problems. Followed colorimetrically. Open-ended.

*PHYS ANAL KEQ NMR PH 4

Experimental Determination of pKa Values by Use of nmr Chemical Shifts
Handloser, C. S.; Chakrabarty, M. R.; Mosher, M. W.
J. Chem. Educ. 50 ,510 (1973)
Water-soluble organic bases, e.g. 4-cyanopyridine titrated in D2O with an internal standard: tetramethylammonium chloride. Pmr shift vs. pH gives titration curve.

*PHYS DENSITY PHASE REFRACT SURFACE VISC 3

A Laboratory Study of Liquid Pairs
Hanson, A. L.
J. Chem. Educ 37 ,143 (1960)
Pedagogical. 2 miscible unknowns issued. Variety of properties of mixtures measured Caution: avoid liquids now known to be carcinogens, eg., chloroform, carbon tetrachloride.

*PHYS APPARATUS SURFACE VACTEK 3 HAZARD

Adsorption of Benzene on Silica Gel: A High Vacuum Experiment
Hanson, J. C., Stafford, F. E.
J. Chem. Educ. 42 ,88 (1965)
Adsorption isotherm. Schematic vac. manifold to use no grease or o-rings. HAZARD: (1) benzene (sample), (2) CHCl3, CCl4 in the freezing mixture. Carcinogens. Avoidable.

*PHYS COLLIG GAS VAPORPRESS 2 HAZARD

A Raoult's Law Experiment For The General Chemistry Course: Manometry Without a Manometer
Harris, F. E.; Nash, L. K.
J. Chem. Educ. 32 ,575 (1958)
Simple setup. No special apparatus. Vapor pressures of two miscible, water-insoluble liquids determined by change of pressure of air trapped over water. HAZARD: benzene (avoidable).

*PHYS GAS STATISTICS THERMO UVIS VAPORPRESS 4

Standard Entropy of Crystalline Iodine From Vapor Pressure Measurements: A physical chemistry experiment
Harris, R. M.
J. Chem. Educ. 55 ,745 (1978)
Thermostatted cell required. Measure vapor pressure spectroscopically.

*PHYS GAS 1

Charles' Law: A general chemistry experiment
Haworth, D. T.
J. Chem Educ 44 ,353 (1967)
No special apparatus.

*PHYS DEMO PHASE 2

A Thermal Analysis Experiment for Introductory Chemistry
Haworth, D. T.; McGrath, J. D.
J. Chem. Educ. 41 ,372 (1964)
Tin-lead eutectic phase diagram. Caution - danger with molten metals (350 deg. C). RPI uses it as a demo (thermocouples, chart recorder, closed circuit TV).

*PHYS ANAL IONX KSP TITN 2

A New Twist to Ksp Evaluation
Hazel, J. F.
J. Chem. Educ. 43 ,636 (1966)
Saturated solution of slightly soluble salt thru cation exchange resin, titrate acid in effluent. Caution: Pb is an embryotoxin.

*PHYS APPARATUS KIN TECHNIQUE UVIS 3

Hydration of Aldehydes: A Temperature-Jump Relaxation Experiment For Physical Chemistry
Heck, H.; Iwata, A.; Mah, F.
J. Chem. Educ. 50 ,141 (1973)
Requires recording spectrophotometer, special apparatus. Data for propanal/50% aq. diglyme given. Suggested questions.

*PHYS COORD EDTA KIN UVIS 2 3

Formation of The Chromium-EDTA Complex: An undergraduate kinetics experiment
Hedrick, C. E.
J. Chem. Educ. 42 ,479 (1965)
Rate of formation of Cr(III)-EDTA complex is followed with a Spec-20, det'nd at various pH values, excess EDTA, to get reaction order in chromium(III) and hydrogen ion.

*PHYS ANAL ACBA COMPUTER DRYLAB PH 3

Computer Simulation of Acid-Base Behavior
Hefter, J.; Zuehlke, R. W.
J. Chem. Educ. 54 ,63 (1977)
Simulates color of methyl red vs. pH. Program available in FORTRAN and in BASIC.

*PHYS COURSE ELECTROCHEM KEQ MOLTENSALT PAPERC REDOX 1

General Chemistry Experiments: Six short inexpensive procedures
Heit, M. L., Dauphinee, G. A.
J. Chem. Educ. 47 ,532 (1970)
Readily available reagents used for experiments designed to be striking and to illustrate some physical concepts: molten salt conductivity, paper chromatography, sublimation, redox, equilibrium.

*PHYS AVOGADRO GAS MICROSCOPE 3

Evaluation of Avogadro's Number: A general chemistry experiment
Henry, P. S.
J. Chem. Educ. 43 ,251 (1966)
Perrin's method. Det'n Boltzmann constant, K, from distribution of particles in suspension. Uses latex spherules, 300x microscope, eccentric pinhole, water, ethanol. Designed for G. Chem., but math would intimidate most freshmen. Refer Slabaugh, W.H., J. Chem. Educ. 42, 471 (1965).

*PHYS PHASE 3 HAZARD

Tie Line Correlation and Plait Point Determination
Heric, E. L.
J. Chem. Educ. 37 ,144 (1960)
HOAc-H2O-benzene. Students follow exp't in standard phys. chem. lab. text, find the lines. Phase diagram given. HAZARD: benzene, carcinogen.

*PHYS PHASE 3

A Phase Rule Experiment: The System Lead Nitrate-Sodium Nitrate-Water
Heric, E. L.
J. Chem. Educ. 35 ,510 (1958)
Straightforward. The triangular diagram is given. Analysis is by the wet residue method of Schreinemakers.

*PHYS APPARATUS CALORIMETRY ELECTROANAL THERMO 3

Heat of Reaction in Aqueous Solution by Potentiometry and Calorimetry: 1. A Metal Displacement Reaction
Hill, D. L.; Moss, S. J.; Strong, R. L.
J. Chem. Educ. 42 ,541 (1965)
Sophisticated equipment. Requires special cell (design given), high-grade potentiometer, temp.-controlled, solution calorimeter. Zn + 2Ag(+) = Zn(++) + 2Ag.

*PHYS COMPUTER GAS KIN STATISTICS 4

Modeling of Molecular Velocity Distributions: A physical chemistry experiment
Hinds, D.; Parrish, D. D.; Wartell, M. A.
J. Chem. Educ. 55 ,670 (1978)
Kinetic theory experiment uses computer-modelled two dimensional gas collisions to develop Boltzmann distribution. Statistical data analysis. Article states that program is available by writing but we got no response.

*PHYS CRYO TECHNIQUE 3

Freezing Point Measurement
Hoare, J. P.
J. Chem. Educ. 37 ,146 (1960)
Not a student experiment. Uses differential thermometer, mechanical stirring. FP obtained by deliberate supercooling, extrapolation (2 ways) back to freezing point. But one should use this not to repeat it, but to modify freezing point measurement techniques.

*PHYS INORG NMR PREP VACTEK 4

A Change in the Sign of an NMR Coupling Constant: An advanced undergraduate experiment
Hoff, J. L.; Furtsch, T. A.; Mills, J. L.
J. Chem. Educ. 56 ,125 (1978)
Demonstrates change in sign of P-C-H coupling constant 2J(P-H) between trivalent and tetravalent phosphorous. Proton nmr. Caution: trimethylborane and trimethylphosphine are pyrophoric and toxic.

*PHYS IR MOL.SPECT QUANTUM 4

Pure Rotation Spectra of HCl and NH3: A physical chemistry experiment
Hollenberg, J. L.
J. Chem. Educ. 43 ,7 (1966)
Spectra given. Gas cell.

*PHYS ATOMIC HISTORIC MOL.SPECT QUANTUM 2

The Spectrum of Atomic Hydrogen
Hollenberg, L. J.
J. Chem. Educ. 43 ,216 (1966)
High voltage discharge tube, Beckman DU. Intensity measured.

*PHYS GAS 1

The Variation of the Mass of a Gas With Its Pressure
Hopkins, D. E.
J. Chem. Educ. 53 ,718 (1976)
Home made gas container from aerosol can; vac pump, tire pressure gauge, foot or hand pump. Permits calc. of atmospheric pressure and R (gas constant).

*PHYS ORG KIN NMR 3

Determination of the Rate of Solvolysis of Benzhydryl Bromide: An nmr experiment
Horman, I.; Strauss, M. J.
J. Chem. Educ. 46 ,114 (1969)
Aqueous-dioxane solvolysis. H^+ conc. measured by shift of nmr absorption with time.

*PHYS DRYLAB RAMAN STRUCT 4

Pure Rotational Raman Spectroscopy: A Dry-Lab Experiment
Hoskins, L. C.
J. Chem. Educ. 54 ,642 (1977)
Explicit directions for student analysis of Raman spectra of hydrogen and carbon dioxide, and determination of bond distances.

*PHYS CATALYSIS HITEMP KEQ 4

Determining the Kp for the Ammonia Synthesis as a Function of Temperature
Huybrects, G.; Petre, G.
J. Chem. Educ. 53 ,443 (1976)
Kp from 820 to 1018 deg. K and 1 atm. pressure. Furnace, apparatus described. Flow rates and concentrations of ammonia are measured.

*PHYS DENSITY PHASE 3

A Simple Method for the Determination of a Liquid-Vapor Equilibrium Curve
Idoux, J. P.
J. Chem. Educ. 46 ,532 (1969)
Vapor and liquid samples (methanol-water) obtained by distillation. Composition measured by density variation. (Archimedean method). Within capacity of many freshmen.

*PHYS PROJ VISC 3

Viscosities of Butanol-Heptane Mixtures
Innes, K. K.
J. Chem. Educ. 38 ,564 (1961)
A problem posed to students to extend existing viscosity measurements of liquid mixtures to larger temperature ranges and determine relationship to simplest temp. visc. equation. Ostwald viscometer.

*PHYS CLATH COORD CRYSTAL DENSITY PREP PROJ XRAY 4 HAZARD

A Physical Chemistry Experiment on Clathrates
Jacobs, G. D.
J. Chem. Educ. 47 ,394 (1970)
Ni(CN)2.NH3.C6H6 is prepared. X-ray powder spectrum, flotation method (for density). HAZARDS: cyanides are highly toxic; benzene and chloroform are carcinogens.

*PHYS ORG ACBA KIN 4

Hydrolysis of Ethyl Acetate in Concentrated Sulfuric Acid: A group experiment for advanced students
Jaques, D.
J. Chem. Educ. 48 ,623 (1971)
Requires 10-12 hours continuous monitoring. Method based on quant. conversion of the ester to its hydroxamic acid, which is det'ned colorimetrically by its ferric chloride complex. Uses Hammett acidity function; reaction mechanism det'n. Study questions.

*PHYS KIN REDOX UVIS 2 3

Oxidation of Benzoin by Hexacyanoferrate(III): An advanced kinetic experiment
Jarrar, A. A.; El-Zaru, R.
J. Chem. Educ. 54 ,326 (1977)
Followed spectrophotometrically (visible). First order in benzoin, ferricyanide, hydroxide. Within capacity of most freshmen.

*PHYS ACBA ELECTROANAL KEQ KSP NOPROC 4

Estimation of Some Ionization and Solubility Product Constants by Potentiometric Titration
Jenkins, D. A.; Latham, J. L.
J. Chem. Educ. 43 ,82 (1966)
Research report, not e student experiment. Gives equations for calculation of ionization constants, etc., from the data and results of pot. titration of a variety of Bronsted acids with NaOH, AgOH. Equations given could be used for a more sophisticated treatment of student data.

*PHYS ANAL PHASE REDOX SOLID SOLUB 4 5

Preparation and Analysis of Solid Solutions in Potassium Perchlorate-Permanganate System
Johnson, G. K.
J. Chem. Educ. 56 ,618 (1979)
Several samples in the nearly ideal solid solution series K(MnO4-,ClO4-) are prepared and analyzed by redox titration of the permanganate ion. A simple theoretical treatment based upon aqueous solubility equilibria is applied. Designed for seniors and graduate students in inorganic chem. Detailed.

*PHYS CRYO CRYO CRYSTAL QUANTUM UVIS 4

Polarized Electronic Absorption Spectrum at 300K and 77K: A physical chemistry laboratory experiment
Johnson, L. W., Wong, K.
J. Chem. Educ. 56 ,275 (1979)
(LiMnO4.3H2O-LiClO4.3H2O) crystal prep'n. Recording spectrometer. Can be done at 300K; better at 77K. Designed to illustrate polarization properties of the electronic transition moment.

*PHYS APPARATUS ELECTROCHEM THERMO 3

Laboratory Experiment Concerning the Gibbs-Helmholtz Relationship
Johnson, R. S.; Crawford, D. E.
J. Chem. Educ. 46 ,52 (1969)
Temp coefficient of E for a lead - lead dioxide cell in a thermostat. Cell constructed from lead sheet and storage battery positive plate.

*PHYS ANAL ORG GC KIN 3

The Methanolysis of Acetal: A chemical kinetics and gas chromatography experiment
Johnston, D. O.
J. Chem. Educ. 44 ,33 (1967)
Catalysed consecutive reactions, first order, plus steady state hypothesis. Typical chromatogram and method of data treatment given. Has worked well here.

*PHYS APPARATUS GAS KEQ THERMO 3

The Thermodynamic Properties of Ammonium Carbamate: An experiment in heterogeneous equilibrium
Joncich, M. J.; Solka, B. H.; Bower, J. E.
J. Chem. Educ. 44 ,598 (1967)
Details of apparatus assembly given. Decomp. of ammonium carbamate in the range 30-50 deg. Celsius, followed by pressure change gives free energy, entropy, and enthalpy for process.

*PHYS ORG ISOTOPE KIN UVIS 4

Kinetic Isotope Effects: An experiment in physical organic chemistry
Jones, J. R.
J. Chem. Educ. 44 ,31 (1967)
Comparison of rates of reaction of acetone and deuterated acetone with hypobromite solution, followed colorimetrically. (330nm).

*PHYS ANAL ACBA CLOCK DEMO ENZYME KIN 3

The Hydration of Carbon Dioxide: A Double Clock Experiment
Jones, P.; Haggett, M. L.; Longridge, J. L.
J. Chem. Educ. 41 ,610 (1964)
Can be used as a simple demo, a more elaborate two indicator demo, or as a student experiment in kinetics. Simple equipment. CO2(aq) + NaOH. Suggest Americans try Club soda as CO2 source. Catalysis by carbonic anhydrase (blood) and by formalin can be demonstrated. Caution: blood can be an infection hazard.

*PHYS ANAL ELECTROANAL MISTAKE 4 HAZARD

Potentiometric Determination of the "Operational" Ksp of AgI
Jurio, R. L.; Ungerer, B.; Manuele, R. J.
J. Chem. Educ. 48 ,122 (1971)
Precision work. The titration cell is Hg/Hg2Cl2(s),KCl(sat'd)//KI(aq.) AgI(s)/Ag; emf msmnts as Ag^+ added dropwise to Ag half-cell. Ksp(AgI), Ag^+ activity calculated. HAZARD: cyanides, can be avoided. (The mistake is in the title of the article.)

*PHYS DENSITY GAS 1

A Simple Molecular Weight Experiment
Kalbus, L.; Petrucci, R. H.
J. Chem. Educ. 48 ,107 (1971)
Dumas method. Weigh a balloon-full of CO2 (dry ice), volume by displacement of water.

*PHYS ANAL INORG APPARATUS COORD PHOTO PREP PROJ 2

Investigation of the Photochemistry of Oxalatobisethylenediaminecobalt(III) Ion: A freshman class project
Kantrowitz, E. R.
J. Chem. Educ. 51 ,202 (1974)
Requires gas analysis train. Open-ended. Explicit directions for preparation of complex compound. Photolysis cell described. Project includes pH, uvis, kin, ionx, etc.

*PHYS INORG APPARATUS HITEMP SOLID VACTEK 4 5

Hydrogen in Zirconium: An experiment in chemical equilibria
Katz, O M.; Gulbransen, E. A.
J Chem Educ 37 ,533 (1960)
Solid-gas equilibria. Furnace to 800 deg. C on vac. system capable of 10(-6) torr (zirconium getter) required. Caution: H2 at 400 deg.

*PHYS APPARATUS SURFACE 3

A Simple, Surface and Interfacial Tension Experiment
Kay, M.; McClure, D. W.
J. Chem. Educ. 47 ,540 (1970)
Double capillary technique used to measure liquid-air and liq.-liq. interfacial tension. Simple apparatus but must be very clean. Traveling microscope or cathetometer.

*PHYS GC 4 HAZARD

Determining Activity Coefficients by Gas Chromatography; A physical chemistry experiment
Kenworthy, S., Miller, J.; Martire, D. E.
J. Chem. Educ. 40 ,541 (1963)
Measure retention vol. of benzene and of cyclohexene on dinonyl phthalate column. HAZARD: benzene is a known carcinogen.

*PHYS APPARATUS MASSPEC THERMO 3

The Latent Heat of Vaporization of an Organic Solid: An undergraduate experiment
Khouw, B. H.; Pritchard, H. O.
J. Chem. Educ. 52 ,730 (1975)
Measurement of heat of vaporization by following line width of mass spectrum of sat'd vapor in He gas carrier over T-range 90-115 deg. C. Data given for benzoic acid.

*PHYS DEMO SOLAR THERMO 0

Solar Energy Storage: A Demonstration Experiment
Kimmel, H. S.; Tomkins, R. P. T.
J Chem Educ 56 ,615 (1979)
CoCl2.6H2O is pink in aq. 2-propanol at room temp., blue when heated by warm water. Reaction is readily reversed upon cooling.

*PHYS APPARATUS ELECTROANAL SURFACE TECHNIQUE 4

The Streaming Potential Electrode: A senior undergraduate electrochemistry experiment
Kimmerle, F. M.; Menard, H.
J. Chem. Educ. 51 ,808 (1974)
Polarography. Special cell, construction details given. High impedence potentiometer required. Intent of exp't is to measure ionic and molecular adsorption at electrified interface.

*PHYS AVOGADRO SURFACE 2

Estimation of Avogadro's Number:
An experiment for general chemistry laboratory
King, L. C. C.; Neilsen, E. K. K.
J. Chem. Educ. 35 ,198 (1958)
First description of a much-used experiment. Measures area and weight of an oleic acid film on water.

*PHYS BIOCHEM CRYSTAL DENSITY XRAY 4

Protein Molecular Weight by X-ray Diffraction
Knox, J. R.
J. Chem. Educ. 49 ,476 (1972)
Technique of growing good protein crystals for X-ray analysis and X-ray photography with a precession camera, two exposure. Density is by density gradient column. Much time for crystal growth and X-ray.

*PHYS ANAL AVOGADRO COURSE GRAVIM RADIOCHEM 2 HAZARD

Cloud Chamber, Molecular Film, and Atomic Weight of Silver: Experiments for general chemistry 1
Kokes, R. J.; Dorfman, M. K.; Mathia, T.
J. Chem. Educ. 39 ,18 (1962)
Describes first three exp'ts Johns Hopkins, Gen. Chem. Simply constructed cloud chamber, radioactive source. Avogadro number by stearic acid monolayer, Ag gravimetrically by chloride. HAZARD: benzene, carcinogen, Stony Brook uses hexane as solvent for this experiment.

*PHYS COURSE GAS NOPROC PHASE VACTEK 2

A Simple Vacuum System: Experiments for general chemistry II
Kokes, R. J.; Dorfman, M. K.; Mathia, T.
J. Chem. Educ. 39 ,20 (1962)
Design of system, general descript. of experiment on Boyle's Law, molecular weight determination, vapor pressure measurement.

*PHYS CALORIMETRY COURSE THERMO 2

Calorimetry Experiments for General Chemistry III
Kokes, R. J.; Dorfman, M. K.; Mathia, T.
J Chem Educ 39 ,90 (1962)
Heat capacity of nickel or copper, heat of neutralization measured in jacketed student calorimeter (inexpensive).

*PHYS CATALYSIS COURSE KEQ VACTEK 2 HAZARD

Chemical Equilibrium - The Hydrogenation of Benzene: Experiments for general chemistry IV
Kokes, R. J.; Dorfman, M. K.; Mathia, T.
J Chem. Educ., 39 ,91 (1962)
Using simple vacuum system, nickel catalyst activated at 270 deg. C. with H2, benzene-hydrogen-cyclohexane equilib. is studied at three to four temperatures Hazard: benzene is a carcinogen, catalyst is pyrophoric, hydrogen is an explosive hazard.

*PHYS ANAL COURSE KEQ SOLUB 2

Equilibria in Ionic Solutions: Experiments for general chemistry V
Kokes, R. J.; Dorfman, M. K.; Mathia T.
J. Chem. Educ. 39 ,93 (1962)
Two to three period study of Ka for chloroacetic acid and Ksp for silver chloroacetate. Latter by silver analysis: former by variation in the solubility of silver salt with pH.

*PHYS GLASS SOLID 2 3

Demonstration of the Glass Transition
Koleske, J. V.; Faucher, J. A.
J. Chem. Educ. 43 ,254 (1966)
Glucose pentaacetate (alpha-D- or beta-D-) forms glass on quick cooling. Hand working to raise temp. (or torsion pendulum to measure effect at different temp.) gives transition to rubbery solid (glass transition temp. 30 deg C.) and then to crystalline powder (cryst. temp. 45-50 deg C.) and finally to melt, 132 deg C. Shear modulus also calc'd.

*PHYS COMPUTER DRYLAB FASTREACTION 4

HO2 Kinetics in Simple Systems. An Introductory Problem in Computer Simulation.
Koop, S. M.; Ogren, P. J.
J Chem. Educ 53 ,128 (1976)
System studied is the flash photolysis of water vapor in the presence of a small amount of O2 and an atmosphere of He or Ar at 25 deg. Celsius. Given the rate constant (taken from literature, not measured) students are asked to determine the conc. of perhydroxy radical as a function of time. Simulation involves rate constants for nine related equations.

*PHYS DRYLAB NMR QUANTUM 4

An NMR Laboratory-Problem for Introductory Quantum Chemistry
Kuhlmann, K. F.; Braun, C. L.
J. Chem. Educ. 46 ,750 (1969)
Using prerecorded or their own nmr spectra, students analyze an AB spectrum. Most emphasis on development of theoretical understanding of the complex equations using quantum theory.

*PHYS PHASE 3 HAZARD

Binary Heterogeneous Vapor-Liquid Equlibrium: A physical chemistry experiment
Kurtyka, Z. M.
J. Chem. Educ. 54 ,389 (1977)
Distillation of immiscible and partly miscible two component systems. Antoine equation. Common lab solvents and water. HAZARD: avoid benzene - a known carcinogen.

*PHYS APPARATUS DIPOLE 3

A New Simple Apparatus for the Measurement of Dipole Moments
Kurtz, S. R.; Anderson, O. T.; Willeford, B. R., Jr.
J. Chem. Educ. 54 ,181 (1977)
Construction details; simple electronics. Requires frequency counter.

*PHYS COMPUTER FLUOR QUANTUM UVIS 4

Vibronic Analysis of the Visible Absorption and Fluorescence Spectra of the Fluorescein Dianion
Kurucsev, T.
J. Chem. Educ. 55 ,128 (1978)
Visible (400-530 nm) and fluorescence (490-600 nm) spectra measured and analyzed.

*PHYS ACBA COMPUTER KEQ KIN PH 4

Determination of pKa of Phenolphthalein and its Discoloration Rate
Lalanne, J. R.
J. Chem. Educ. 48 ,266 (1971)
Developed for sec. school teachers. All equipment should be available, [illegible]ter schools. 4 equilibria. Results from many experiments computer averaged.

*PHYS ORG EXCHANGE ISOTOPE KIN NMR 3

An NMR Demonstration of Isotopic Exchange
Lapidot, A.; Reuben, J.; Samuel, D.
J. Chem. Educ. 41 ,570 (1964)
Hydroacrylonitrile undergoes deuterium exchange with a D20-NaOH mixture, analysis by NMR. Integration of peak intensities leads to rate constant.

*PHYS ISOTOPE MASSPEC NOPROC 3

Relative Isotopic Abundances in Halogenated Methane Fragments: An undergraduate experiment
Leech, J. R.; Daugherty, K. E.
J. Chem. Educ. 50 ,569 (1973)
CCl4, CHCl3, CH2Cl2, CBrCl3, CH3I. Caution: chloroform and carbon tet. are carcinogens, but could be handled safely for masspec. work.

*PHYS CLOCK KIN OSC.RXN 2

The Color Blind Traffic Light: An undergraduate kinetics experiment using an oscillating reaction
Lefelhocz, J. F.
J. Chem. Educ. 49 ,312 (1972)
Ceric ammonium sulfate, KBrO3, malonic acid, ferroin, H2SO4. Concentration, temp., and pH varied.

*PHYS FLUOR KIN UVIS 3 HAZARD

The Rate Constant For Fluorescence Quenching: An undergraduate experiment using the spectronic 20
Legenza, M. W.; Marzzacco, C. J.
J. Chem. Educ. 54 ,183 (1977)
Anthracene fluorescence quenching by CCl4. Stern-Volmer mechanism.
HAZARD: CCl4, carcinogen.

*PHYS GRAVIM NOPROC QUANTUM 2

The Planck Radiation Law and the Efficiency of a Light Bulb
Leiman, I. A.
J. Chem. Educ. 49 ,832 (1972)
A "first experiment" using analytical balance. The efficiency of the light bulb is calculated as the ratio of visible light energy to total emitted energy calculated from Planck radiation equation as measured (weight) from "visible" and total energy portions of curves. Heat emitted measured by calorimetry. Study questions and suggested extensions. Caution: electric light bulbs near water are a shock hazard.

*PHYS DEMO TECHNIQUE TRANSPORT 3

"Two-Penny" Experiments in Chemical Engineering
Lemlich, R.
J. Chem. Educ. 34 ,489 (1957)
Demos described for demonstration purposes in a units operations course-tnat is, on a small scale rather than in a pilot plant. Demos include fluid flow, heat transfer, distillation, etc. Minimal procedures.

*PHYS DISTRIB NOPROC UVIS 3

A Laboratory Experiment Using Indicators
Leonard, C. B., Jr.
J. Chem. Educ. 44 ,363 (1967)
Two indicators used to measure countercurrent distribution patterns by colorimetry.

*PHYS COMPUTER EXCHANGE KIN NMR 4

Kinetics of Proton Exchange of Trimethylammonium Ion by NMR: A laboratory experiment
Leyden, D. E.; Morgan, W. R.
J. Chem. Educ. 46 ,169 (1969)
Spectra of methyl and water protons at varying pH measured. Line shape (FORTRAN program available) used to calculate relaxation times.

*PHYS GAS VACTEK VAPORPRESS 2 3

A Simple Isoteniscope and An Improved Method of Vapor Pressure Determination Experiment
Lindauer, M. W.
J. Chem. Educ. 37 ,532 (1960)
Simple apparatus. Manometer, thermostatted bath, organic liquids.
Caution: avoid CCl4, a carcinogen.

*PHYS APPARATUS DIFFUSION UVIS 4

The Diffusion Coefficient of Sucrose in Water: A Physical Chemistry Experiment
Linder, P. W.; Nassimbeni, L. R.; Poson, A; Rodgers, A. L.
J. Chem. Educ. 53 ,330 (1976)
Theory discussion not simple. Stainless steel diffusion cell. Concentration measured colorimetrically. One 3-hr. lab period.

*PHYS ELECTROANAL KIN TECHNIQUE 4

An Undergraduate Experiment in Chemical Engineering Reactor Kinetics
Lindfors, L. E.
J. Chem. Educ. 48 ,472 (1971)
Flow rates in a reactor monitored conductimetrically to obtain sec. order rate constant for reaction of EtOAc and NaOH. Chemical engineering exp't, to measure characteristics of batch, plug flow, and backmix reactors.

*PHYS ORG COMPUTER HPRESS KIN NMR NONAQ VACTEK 4 5

A High Pressure, Nonaqueous Reaction Rate Experiment For Advanced Students
Litchman, W. M., Teague, S. V.
J. Chem. Educ. 49 ,560 (1972)
Study of rate of $CH_3Cl + NH_3 = CH_3NH_3Cl$ followed by NMR. FORTRAN program for calculating rate constant included. Complete and detailed. Caution: chloroform, carcinogenic, handled on vacuum line.

*PHYS KIN REDOX UVIS 3 HAZARD

Kinetics of Oxidation of Benzyl Alcohol
Liu, M. T. H.
J. Chem. Educ. 48 ,703 (1971)
Oxidant, $KMnO_4$. Rx is carried out in dil. $HClO_4$, followed either by I_2 titration or colorimetrically. Rate law, activation energy determined. HAZARD: $HClO_4$ is a storage hazard.

*PHYS DEMO DRYLAB OPTICAL QUANTUM 1

Some Experiments in Atomic Structure
Logan, K. R.
J. Chem. Educ. 51 ,411 (1974)
A color-film camera is used with a grating to record standardized spectrograms from discharge tubes. Slides are then made up, used as the basis of a drylab by students to measure first 4 lines of Balmer series, calculate Rydberg constant, ionization energy, etc.

*PHYS ELECTROCHEM TRANSPORT 3 HAZARD

Transport Numbers and Ionic Mobilities by the Moving Boundary Method
Lonergan, G. A.; Pepper, D. C.
J. Chem. Educ. 42 ,82 (1965)
Absolute ionic mobilities. Special cell, Cd anode. Power supply. HAZARD: Cd metal and solutions extremely toxic.

*PHYS APPARATUS NOPROC SURFACE THERMO 4

A Gas Adsorption Apparatus and Experiment
Lutrick, H. G.; Williams, K. C.; Maatman, R. W.
J. Chem. Educ. 41 ,93 (1964)
Student-built apparatus. Compressed gases. BET theory. Thermal conductivity cell.

*PHYS FREERAD KIN 2

The Thermal Decomposition of Azobisisobutyronitrile: A simple kinetics experiment
MacCallur, J. R.
J. Chem. Educ. 48 ,705 (1971)
Commonly available AIBN decomposes to N_2 gas and a free radical. Simple apparatus.

*PHYS CALORIMETRY THERMO 2

A Simple Ice Calorimeter: A first experiment in Thermochemistry
Mahan, B. H.
J. Chem. Educ. 37 ,634 (1960)
Heat of reaction, eg. magnesium metal and hydrogen ion, measured by volume change of ice-water mixture in an inexpensive calorimeter.

*PHYS KEQ THERMO 2

Temperature Dependence of Equilibrium: A first experiment in general chemistry
Mahan, B. H.
J. Chem. Educ. 40 ,293 (1963)
Data for cooling curves are obtained for pure naphthalene and 3 mixtures of diphenylamine:naphthalene. Enthalpy of fusion evaluated from data. No special equipment.

*PHYS APPARATUS GAS VISC 4

Determination of the Viscosity Coefficients of Gases
Malinauskas, A. P.; Whisenhunt, S. J., Jr.; Searcy, J. Q.
J. Chem. Educ. 46 ,781 (1969)
Apparatus requires glassblowing; easy to use. Ar, CO_2, N_2, air, O_2, Ne behave normally. He shows abnormal behavior. Theory developed.

*PHYS INORG COORD KIN UVIS 3

An Undergraduate Kinetics Experiment Demonstrating Unusual Behavior of the Observed Equilibrium Constant
Malin, J. M.; Toma, H. E.; Giesbrecht, E.
J. Chem. Educ. 54 ,385 (1977)
Formation of deep-blue pentacyano(N-methylpyrazinium)ferrate(II) from light-yellow similar S-bonded DMSO complex followed spectrophotometrically. Preparations of reactants by reference.

*PHYS COMPUTER NOPROC QUANTUM 4

Analog Computer Solution of a Particle in a Finite Well: A physical chemistry experiment
Marron, M. T.
J. Chem. Educ. 50 ,289 (1973)
2 lab periods focus on how to use computers, patch boards, etc. Use computer to solve Schroedinger equation. Write-up avail. from author. Systron Donner #3300 analog computer.

*PHYS DRYLAB XRAY 5

Interpretation of a Patterson Map - A Dry-Lab Experiment in X-ray Crystallography
Marsh, R. E.; Nordman, C. E.
J. Chem. Educ. 54 ,318 (1977)
Student who has completed a 10-wk course in X-ray diffraction will req. approx. 10-15 hrs to complete this problem.

*PHYS APPARATUS GAS VACTEK 3

A Student Apparatus for Measuring the Second Virial Coefficients of Vapors
Martin, M. L.; Dunlop, P. J.
J. Chem. Educ. 46 ,615 (1969)
Nitrogen and pure hexane carefully dried, introduced into special apparatus with volume measurement and mercury manometer. Theory also.

*PHYS ANAL COMPLEX DEMO NOPROC SOLUB STOICH 2

A Simple Demonstration of Some Precipitation and Solubility Effects
Matijevic, E.; Kratohvil, J. P.; Kerker, M.
J. Chem. Educ. 38 ,397 (1961)
Method of continuous variation applied to the Ag^+/Br^- system. Special attention is paid to those parts of the solubility diagram where complex formation and AgBr sol'ns occur. No procedure, either for exp't or demo.

*PHYS INORG DEMO NOPROC PROJ THERMO 2

Demostrations of Spontaneous Endothermic Reactions
Matthews, G. W. J.
J. Chem. Educ. 43 ,476 (1966)
Short note. Transition metal chlorides (hydrated) react spectacularly with thionyl chloride, mostly endothermically, often with HCl evolved. This is proposed either as a demo or a student project in thermochemistry. WARNING: Take sensible precautions with these reactions. If this article had been more explicit, we would have tagged it with "HAZARD".

*PHYS ANAL COMPUTER ELECTROCHEM KIN TECHNIQUE 4

Reaction Rate of Ethyl Acetate Hydrolysis by Oscillometry
McCormick, P. G.
J. Chem. Educ. 48 ,558 (1971)
Determination of second-order rate constant in alk. hydrolysis of ethyl acetate. Req. oscillometer and recorder. Ambient temperature.

*PHYS ORG NOPROC PHASE SEPARATION 2

The Azeotrope - An Introduction to Distillation
McCullough, T.; Nowicki, J. E.
J. Chem. Educ. 51 ,323 (1974)
Determination of azeotrope composition and B.P. for various substances with water.

*PHYS DEMO KIN 2

Thermodynamic verses Kinetic Control: A Lecture Demonstration.
McNaught, I. J.
J. Chem. Educ. 55 ,722 (1978)
Reaction of mercuric ion with iodide ions can yield either rhombic HgI_2 (yellow) or tetragonal HgI_2 (orange) depending on concentrations.

*PHYS CRYO 2

Molecular Weights by Cryoscopy: A general chemistry laboratory experiment
Mikulak, R.; Runquist, O.
J. Chem. Educ. 38 ,557 (1961)
Cyclohexanol has a large cryoscopic constant (39), and melts near room temperature. Simple method described to protect system from atm. moisture. Solute: benzoic acid, unknowns.

*PHYS COORD DEMO KEQ THERMO 2

Reversible Formation of Aluminum Xylenol Orange by Temperature Variation: An Experiment Demonstrating the Entropy Effect
Miller, F. L., Fog, H. M.
J. Chem. Educ. 50 ,147 (1973)
Keq for reaction of aluminum ion with xylenol orange (multidentate) can be evaluated by spectroscopic determination of the orange complex at 550 nm. Stoichiometry and thermodynamic properties are calculated. Demo: shows color change on heating as an entropy effect.

*PHYS QUANTUM UVIS 4

The Spectrum of Atomic Lithium: An undergraduate laboratory experiment
Miller, K. J.
J. Chem. Educ. 51 ,805 (1974)
Bausch and Lomb 1.5M Spectrograph yields line spectrum on photographic film. Student is to construct a complete energy-level diagram for atomic lithium.

*PHYS CLOCK DEMO DENSITY 2

Density Gradients in Chemistry Teaching
Miller, P. J.
J. Chem. Educ. 49 ,278 (1972)
Assorted things to do with density columns - columns of liquids with a composition and density gradient. Includes an interesting variation on the iodine clock.

*PHYS GAS KEQ PH 1 2

A Discovery Experiment: CO2 Soap Bubble Dynamics
Millikan, R. C.
J. Chem. Educ. 55 ,807 (1978)
Qualitative. Fun. Used at UC to provide positive motivation, change of pace. Dry ice, commercial "bubble-stuff". Why do bubbles grow?

*PHYS CATALYSIS DEMO ELECTROANAL KIN OSC.RXN REDOX 3

Belousov's Oscillating Reaction in Acidic Medium Other Than Sulfuric Acid
Mishra, H. C., Singh, C. M.
J. Chem. Educ. 54 ,377 (1977)
Mn(II)-catalyzed reaction between citric acid and potassium bromate in phosphoric and nitric acids followed potentiometrically and by change of color of solution.

*PHYS KIN UVIS 2

First-Order Decomposition of the Violet Colored Ce(IV) Oxidation Product of N-Phenylanthranilic Acid.
Mishra, S. K.; Sharma, P. D.; Gapta, Y. K.
J. Chem. Educ. 53 ,327 (1976)
The endpoint color in std. Ce(IV) by Fe(II) to the N-phenylanthranilic acid decays with time, following first order kinetics, k=(2.63*/- 0.16) x 10(-3) recip. sec.; Spec-20 required. The nature of the decomp. of the oxidized form is not known.

*PHYS CLOCK KIN 2 3

The Oxidation of Iodide Ion by Persulfate Ion
Moews, P. C.; Petrucci, R. H.
J. Chem. Educ. 41 ,549 (1964)
Iodine-clock, with concentrations adjusted to give short reaction times. Rate of oxidation of iodide by persulfate followed by adding an aliquot of std. thiosulfate and starch. Activation energy effect of Cu(II) (catalyst) and ionic strength.

*PHYS DIPOLE KEQ STEREO THERMO 3 HAZARD

Thermodynamics From Dipole Moments
Moffat, J. B.
J. Chem. Educ. 43 ,74 (1966)
Measured dielectric constants of mixtures of cis- and trans- isomers of propyl nitrite (HAZARD: cardiac-respiratory stimulant) used with bond dipole moments to calculate isomer composition and free energy of isomerization.

*PHYS CORROSION KIN UVIS 2 HAZARD

Dissolving Iron Nails: A kinetics experiment
Monaghan, C. P.; Fanning, J. C.
J. Chem. Educ. 55 ,400 (1978)
Rate of reaction of iron metal with dilute HCl yielding Fe^{++}, H2 followed by oxidation of Fe^{++} to ferric, colorimetric by thiocyanate. Rate is proportional to surface area, inversely to volume of solution. HAZARD: liq. Br2.

*PHYS QUANTUM RAMAN UVIS 4 5

Vibronic Spectra and Energy Levels of Polyatomic Molecules: A physical chemistry experiment
Moomaw, W. R.; Skinner, J. F.
J. Chem. Educ. 48 ,304 (1971)
Student measures and assigns vapor-phase vibronic spectrum of pyrazine and chlorobenzene. Vapor spectra at 373 K.

*PHYS APPARATUS FASTREACTION KIN 4

A Kinetic Experiment Using a Spring-Powered, Stopped-Flow Apparatus
Morelli, B
J Chem Educ 53 ,119 (1976)
Design given for a very inexpensive and easy-to-build stopped-flow apparatus for the study of very fast reactions; suggested uses, undergraduate instruction and research. Emphasis on construction of equipment. Oscillograph.

*PHYS ACBA COORD KEQ 3 HAZARD

The Effect of Ligands on Hydrolysis Constants of Transition Metal Ions
Morrow, J. I.
J Chem. Educ. 49 ,748 (1972)
Determination of the acid ionization constant for Cr(H2O)6***, by measuring pH of dilute Cr(ClO4)3 solutions. L&N pH meter. Cr*3 solutions must be aged three months. Caution: perchlorates, storage hazard.

*PHYS MASSPEC QUANTUM 4

A Mass Spectroscopy Experiment
Morse, R. I
J. Chem. Educ. 48 ,398 (1971)
Quadrupole mass spec. CH3OH, C2H5OH, 1-propanol, 1-butanol. Rice-Ramsperger-Kassel theory of fragmentation.

*PHYS CLOCK DEMO KIN 1

The Landolt, "Old Nassau", and Variant Reactions
Moss, A
J Chem. Educ. 55 ,244 (1978)
Variants of iodine-clock, and other clock expts, described.

*PHYS APPARATUS CALORIMETRY ELECTROANAL THERMO 4

Heat of Reaction in Aqueous Solution by Potentiometry and Calorimetry. II A redox reaction
Moss, S. J.; Hill, D. L.
J Chem Educ. 42 ,544 (1965)
Ferrous-ceric reaction in H2SO4. Enthalpy two ways: temperature coefficient of emf vs. direct calorimetry. High-quality apparatus. Three-hour experiment. See part I.

*PHYS ANAL INORG CRYSTAL DENSITY INTEGR PREP XRAY 4

Synthesis and Structure of Magnesium Oxide or Calcium Oxide: An integrated inorganic-physical experiment
Moyer, R. O.
J. Chem. Educ. 52 ,612 (1975)
Oxides are prep'd by thermal decomposition of the oxalates. Muffle furnace. Density on pressed pellets. X-ray diffraction. Elemental analysis by reference.

*PHYS DENSITY ELECTROCHEM MOLTENSALT VISC 4

A Low Temperature Fused Salt Experiment: The Conductivity, Viscosity, and Density of Molten Calcium Nitrate Tetrahydrate
Moynihan, C. T.
J. Chem. Educ. 44 ,531 (1967)
This is a classic paper in low-temp. molten-salt chemistry. Ca(NO3)2.4H2O melts at 42.7 deg. C. Conductivity cell, Wheatstone bridge, Ubbelohde viscometer, Westphal balance.

*PHYS AVOGADRO REVIEW 2

Determining Avogadro's Number from the Volume of a Monolayer
Moynihan, C. T.; Goldwhite, H.
J. Chem. Educ. 46 ,779 (1969)
Recommendations about best technique (J. Chem. Educ., 39, 18(1962)) for a classical experiment and about method of calculation.

*PHYS DEMO GAS 2

A Charles' Law Experiment Using a Balloon or a Plastic Bag
Mudrock, H. D.; Hawthorne, R. M. Jr.
J. Chem. Educ. 50 ,528 (1973)
Straightforward; could be used for a "first" experiment.

*PHYS COMPUTER KIN TITN 3

A Computer Program for Chemical Kinetics by Titration
Musulin, B.
J. Chem. Educ. 46 ,109 (1969)
Program (available) calculates rate constants for saponification of ethyl and propyl acetate assuming second order and also (for pedagogic purposes) assuming equilibrium. Effects of number of data points, different methods of solution shown.

*PHYS CALORIMETRY REVIEW 2 3

Thermochemical Investigations for a First-Year College Chemistry Course: A survey of existing literature
Neidig, H. A.; Schneider, H.; Teates, T. G.
J. Chem Educ 42 ,26 (1965)
A survey of literature on thermochemical experiments in J. Chem. Educ. and other sources. 39 references.

*PHYS ANAL INORG INTEGR KEQ 2 3

The Chemistry of Orthophosphoric Acid and Its Sodium Salts
Neidig, H A., Teates, T. G.; Yingling, R. T.
J. Chem. Educ. 45 ,57 (1968)
Suggests possible lab expts from 1st year to 3rd year courses involving dissociation, hydrolysis, and disproportionation. Minimal directions.

*PHYS ANAL KEQ PHASE SOLUB 4

Investigation of Interaction in the Pb(NO3)2-NaCl-Methanol-Water System
Neidig, H A , Yingling, R T.
J. Chem Educ. 42 ,475 (1965)
Solubility data collected via class project. Gravimetric analysis plus chloride titration. Finally, construct a model for the system and interpret the results in terms of the model.

*PHYS ACBA CALORIMETRY SOLID THERMO 2

Enthalpies of Formation of Solid Salts
Neidig, H. A.; Yingling, R. T.
J. Chem. Educ. 42 ,474 (1965)
Measure heat of neutralization NH3 aq. plus hydrochloric or nitric or sulfuric acid, and also heat of solution of salts, with tabulated thermo data can calc. enthalpy of formation of ammonium salts.

*PHYS CALORIMETRY KEQ NOPROC THERMO TITN 2

Thermodynamics of the Ionization of Acetic and Chloroacetic Acids
Neidig, H. A., Yingling, R. T.
J. Chem Educ. 42 ,484 (1965)
Students determine Ka by pH meter titration, enthalpy of neutralization by thermal cup procedure.

*PHYS KEQ PHASE SOLUB THERMO 3

Interaction in Chemical Systems
Neidig, H. A.; Yingling, R. T.; Lockwood, K. L.; Teats, T. G.
J. Chem. Educ. 42 ,368 (1965)
Second paper in series of measuring interactions in methanol-water. Here uses solubilities of inorganic salts in mixed solvent to calc. thermodynamic quantities and a model of structural interactions. Much discussion.

*PHYS GAS KEQ THERMO VACTEK 2

Lecture Experiment: A Quantitative Illustration of Le Chatelier's Principle
Nelson, D. L.; Ginns, E. I.; Richtol, H.; Reeves, R. R.
J. Chem. Educ. 50 ,721 (1973)
Simple apparatus allows demo of measurement of P-total of system N2O4=2NO2 equilibrium mixtures versus temperature. Data allows calculation of degree of dissociation of N2O4. Caution: toxic gases.

*PHYS ORG CATALYSIS IONX KIN 3

Heterogeneous Catalysis: Resin-Catalyzed Saponification of Methyl Acetate
Nieto, A.
J. Chem. Educ. 50 ,846 (1973)
Straightforward. Simple apparatus. Within capacity of many freshmen.

*PHYS APPARATUS DIFFUSION MICROSCOPE 3

Diffusion Under the Microscope
Nishijima, Y.; Oster, G.
J. Chem. Educ. 38 ,114 (1961)
Inexpensive apparatus allows diffusion coeff. measurement in short time. Experiments with true liquids. Metallized microscope slides; interference pattern; Hg lamp and filter.

*PHYS APPARATUS EXPLOSION KIN THERMO VACTEK 4

The Hydrogen-Oxygen Second Explosion Limit: A physical chemistry experiment
Ogilvie, J. F.
J. Chem. Educ. 48 ,342 (1971)
Diagram of gas-handling system given. Activation energy by varying temp. Caution: explosion potential of hydrogen.

*PHYS APPARATUS GAS HITEMP VISC 4

Determining the Intermolecular Potential Energy in a Gas:
A physical chemistry experiment.
Olbregts, J.; Walgraeve, J. P.
J. Chem. Educ. 53 ,602 (1976)
Viscosity of propane as a function of temperature to 650 deg. Celsius. Diagrams of viscometer and electronic clock given. Parameters of Lennard Jones intermolecular potential; virial coefficients calc'n. Data given.

*PHYS ANAL ACBA DEMO KEQ PH 2

Weak and Strong Acid and Buffers
Ophardt, C. E.
J. Chem. Educ. 53 ,229 (1976)
Metacresol purple, bromocresol green used to show acidity of various mixtures of HCl/HOAc/NaOAc.

*PHYS APPARATUS SOLUB /2

Experiment on Solubility as a Function of Temperature
Pacer, R. A.
J. Chem. Educ. 48 ,225 (1971)
Reports successful class use of Bronsted-Davies saturator in an extension of a classical solubility experiment (Wolthius, 1960).

*PHYS COMPUTER KIN RADIOCHEM STATISTICS 2

Some Simple Classroom Experiments on the Monte Carlo Method
Para, A. F.; Lazzarini, E.
J. Chem. Educ. 51 ,336 (1974)
Freshman nuclear physics or chem course, calculation of decay, statistical fluctuation of decay rate.

*PHYS APPARATUS FASTREACTION KEQ 5

Fast Reactions: Rapid Mixing and Concentration Jump Experiments
Patel, R. C.; Atkinson, G.; Boe, R. J.
J. Chem. Educ. 47 ,800 (1970)
Advanced technique experiment. Apparatus construction described. Rate of denydration of carbonic acid, concentration jump expt. with carbonic acid, and concentration jump expt. with pyruvic acid described.

*PHYS CRYSTAL ELECTROCHEM HITEMP SOLID 4

An Experiment in Solid State Chemistry: The Mobilities of Ionic Defects in Silver Bromide
Perrino, C. T.; Peacock, S.
J. Chem. Educ. 50 ,508 (1973)
AC conductivity measurements on silver bromide doped with CdBr2 melted and cooled with electrodes in place. Requires lots of silver; temperatures over 220-250 degrees C.

*PHYS CRYSTAL ELECTROCHEM HITEMP SOLID 4

An Experiment in Solid State Chemistry: Conduction in Silver Iodide
Perrino, C. T.; Wentrcek, P.
J. Chem. Educ. 49 ,543 (1972)
Explicit directions for determination of ionic conductivity in solid AgI, 100-160 degrees C. Standard DC technique. Defect chemistry of solids.

*PHYS ANAL INORG KSP PREP 2

The Solubility Product Constant for Copper Iodate
Peterson, B. H.
J. Chem. Educ. 34 ,612 (1957)
Copper(II) iodate prepared. Solution in equilib. with solid analyzed iodimetrically (directions minimal).

*PHYS ELECTROCHEM 2

A Simple Quantitative Electrolysis Experiment for First-Year Chemistry
Petrucci, R. H.; Mowls, P. C.
J. Chem. Educ. 41 ,552 (1964)
Two beakers cont. aq. Na2SO4, metal foil electrodes, 6-volt batteries, agar salt bridge. Aliquot of std. acid + indicator added to cathode compartment. Student determines acid conc. by noting time, current needed to change ind. color. Compared to standard.

*PHYS ORG PHOTO UVIS 3

A Quantitative Photochemical Experiment for Undergraduates
Phillips, D.
J. Chem. Educ. 48 ,198 (1971)
Biacetyl, irradiated at 300 nm, undergoes enolization. The enol has a strong UV absorption band, used to follow the reaction. Quantum yield via ferric actinometer.

*PHYS COMPUTER DRYLAB MOL.SPECT QUANTUM 5

A Computer Experiment in Microwave Spectroscopy
Pollnow, G. F.; Hopfinger, A. J.
J. Chem. Educ. 45 ,528 (1968)
Very advanced experiment using lit. values and computer program (available) to calculate frequencies, energy levels for unsymmetrical molecules.

*PHYS ORG APPARATUS KIN VACTEK 4

Laboratory Experiments in Gas Kinetics: decomposition of di-t-butyl peroxide and norbornylene
Price, A. H.; Baker, R. T. K.
J. Chem. Educ. 42 ,614 (1965)
Rate of decomp. followed by pressure change. Special apparatus: jacketed reaction chamber on vac. line. Explosive hazard - shield required. Reader (DT) points out norbornylene is usually called norbornene.

*PHYS CATALYSIS KIN NOPROC VACTEK 4

Heterogeneous Kinetics in the Laboratory: The Decomposition of Ammonia on a Tungsten Surface
Pryce-Jones, T.
J. Chem. Educ. 49 ,848 (1972)
Describes construction of reaction chamber for a gas line from a projector bulb modified by glassblowing. Temperature can be measured from resistance of the filament. Little detail, ref. to phys. chem. lab text.

*PHYS VAPORPRESS 2

Vapor Pressure Determination
Radley, E. T.
J. Chem. Educ. 37 ,35 (1960)
The approx. vapor pressure of low-boiling liquids is estimated by measuring the increase of an air column trapped in glass tubing between two mercury drops when the liquid is introduced between them and allowed to volatilize.

*PHYS ANAL KEQ SOLUB TITN 3

The Instability Constant of the I3- = I- • I2 System: A Student Experiment
Ramamurti, G.; Renganathan, K.; Ganesan, L. R.
J. Chem. Educ. 53 ,326 (1976)
An alternative and simpler method for the classical procedure wherein the iodine is extracted with carbon tetrachloride. This method equilibrates solid iodine with potassium iodide solutions. Aliquots of aq. layer are titrated with standard thiosulfate. Within capacity of many freshmen.

*PHYS ANAL INORG KEQ PREP 3 HAZARD

The Dissociation Constant of Iodic Acid:
Experiments for the analytical laboratory
Ramette, R. W.
J. Chem. Educ. 36 ,191 (1959)
Solubility of copper iodate (prepared) in solutions of varying acidity with lithium or sodium perchlorate to give constant ionic strength. Permits graphical estimation of acidity constant.
HAZARD: Perchloric acid is a storage hazard.

*PHYS COMPLEX ELECTROCHEM KEQ 3

Silver Equilibria via Cell Measurements:
A quantitative laboratory experiment
Ramette, R. W.
J. Chem. Educ. 49 ,423 (1972)
Equilibrium constant for complex formation of silver(I) with chloride, bromide, and ammonia is measures potentiometrically.

*PHYS COORD KEQ UVIS 3

Formation of Monothiocyanatoiron(III):
A photometric equilibrium study
Ramette, R. W.
J. Chem. Educ. 40 ,71 (1963)
The formation complex of the coordination compound is measured colorimetrically as a function of the total iron(III) concentration.

*PHYS ANAL COMPLEX NOPROC 3

The Nature of Dissolved Silver Acetate
Ramette, R. W.
J. Chem. Educ. 43 ,299 (1966)
Students are given the problem of possible complex formation and some suggestions on how to proceed experimentally. An determination of silver ion concentration in the presence of varying amounts of acetate at constant ionic strength (sodium perchlorate) is strongly suggested.

*PHYS ACBA GROUP KEQ PROJ UVIS 3

The Dissociation Quotient of Bromcresol Green:
A class study of ionic strength effects
Ramette, R. W.
J. Chem. Educ. 40 ,252 (1963)
Measure visible absorption at various pH values and ionic strengths to find the dissociation constant. Graphical method of solution.

*PHYS APPARATUS DTA 3

Differential Thermal Analysis With a Fisher Johns Apparatus
Reed, K.
J. Chem. Educ. 41 ,606 (1964)
Emphasis on modification (substantial). Some student experiments on decomposition and phase transition (not discussed).

*PHYS ORG KEQ NOPROC THERMO UVIS 3

A Molecular Complex Suitable For Spectrophotometric Investigation
Rehwoldt, R. E.; Boynton, E.
J. Chem. Educ. 42 ,648 (1965)
2,3-Dichloro-5,6-dicyanobenzoquinone (DDQ) forms green pi complex with naphthalene in CH2Cl2. Measurements at two temperatures to calculate Keq, heat of formation. 3 lab periods.

*PHYS GRAVIM KSP TITN 1

Ksp Experiment: The Solubility Product for Barium Hydroxide
Reynolds, J. P.
J. Chem. Educ. 52 ,521 (1975)
Simple experiment to determine conc. Ba^{++} and OH^- above barium hydroxide.

*PHYS COMPUTER DECAY FLUOR KIN QUANTUM 4

Determination of the Activation Energy of a Non-radiative Decay Manifold: A physical chemistry experiment
Ricci, R. W.
J. Chem. Educ. 51 ,692 (1974)
Effect of temp. on fluorescence yield of indole, analyzed by curve fitting data to determine constants.

*PHYS COMPUTER IR ISOTOPE MOL.SPECT QUANTUM UVIS 3

The Infrared Spectra of Four Isotopes in HCl: A molecular structure experiment
Richards, L. W.
J. Chem. Educ. 43 ,552 (1966)
Pt, D, Cl-35, Cl-37 in HCl. Spectra analyzed by computer program, avail. from author. Cary 14, 2.35-2.55 micron.

*PHYS COMPUTER MOL.SPECT PREP QUANTUM UVIS 3

The Infrared Spectra of C2H2 and C2D2
Richards, L. W.
J. Chem. Educ. 43 ,644 (1966)
Preparation and molecular spectroscopy. Theoretical background. Cary 14, 1.5-2.0 microns.

*PHYS APPARATUS DEMO OPTICAL UVIS 2

A Vidicon Detection System for Teaching Absorption Spectroscopy
Richtol, H. H.; Nelson, D. L.; Reeves, R. R., Jr.
J. Chem. Educ. 52 ,218 (1975)
Describes conversion of a TV set to a spectrograph for viewing by large audiences.

*PHYS ANAL APPARATUS DEMO OPTICAL QUANTUM UVIS 2

Converting a Television System into a Quantitative Atomic Emission Spectrograph.
Richtol, H. H.; Reeves, R. R.; Nelson, D. L.
J. Chem. Educ. 52 ,198 (1975)
Conversion by placing a transmission grating on the lens of a TV camera focussed on a discharge tube.

*PHYS KSP SOLUB THERMO 2

Thermodynamics and Solubilities of Salts of Dipositive Ions
Riley, G. F.; Eberhardt, W. H.
J. Chem. Educ. 56 ,206 (1979)
Chlorides, sulfates, carbonates, and hydroxides of Ba, Ca, Mg, Cu, Pb, Zn. Student calculates solubility from free-energy of formation at 0.1M tables (pre-lab) and then checks results in lab.

*PHYS DEMO FLUOR MICELLE 2

Enhancement of Concentration Quenching by Micelles
Roessler, N.
J. Chem. Educ. 56 ,675 (1979)
Fluorescence of the dianion in solutions of the sodium salt of fluorescein is quenched by cetyltrimethylammonium bromide above the critical micelle concentration.

*PHYS ORG APPARATUS CALORIMETRY THERMO 4

Heats of Hydrogenation: A physical-organic laboratory experiment
Rogers, D. W.; McLafferty, F. J.
J. Chem. Educ. 48 ,548 (1971)
Reaction chamber of a new safer calorimeter described. Thermistor, bridge and galvanometer. Hydrogen at 80 cm Hg above atmosphere. Palladium black catalyst. Results given for cyclohexene, 1,7-octadiene, etc.

*PHYS COMPUTER DRYLAB KIN 4 5

Simulation of Experimental Data, the Design of Experiments, and the Analysis of Results: Kinetics of Catalyzed Ester Hydrolysis
Rosenthal, D.; Arnold, D.
J. Chem. Educ. 54 ,323 (1977)
The student is presented by the computer with a large array of information on the hydrolysis of p-methylphenyl formate, and is asked to design experiments to answer questions such as "Is there evidence for H^+-catalyzed reactions?", etc. Suitable for graduate students. Kinetics simulation program (KESIP) available.

*PHYS EXCHANGE GAS ISOTOPE KEQ STATISTICS VACTEK 4

The DCl-HBr Isotope Exchange Equilibrium: A statistical and experimental exercise for the physical chemistry laboratory
Ruark, J. E.; Ivers, J. I.; Roberts, J. L.
J. Chem. Educ. 51 ,758 (1974)
Exp. conf. of a statistically predicted eq. const. Uses Cary Model 14 spectrophotometer, gas cell. Discusses theory.

*PHYS GAS KIN MASSPEC VACTEK 3

The Thermal Decomposition of 2,5-Dihydrofuran Vapor
Rubin, J. A.; Filseth, S. V.
J. Chem. Educ. 46 ,57 (1969)
Dihydrofuran decomposes at 300-400 C to furan and hydrogen. Rate by pressure change. Activation energy by rate variance with temp. Optional mass spectral product analysis.

*PHYS CATALYSIS COMPLEX DEMO KIN 1 2

A Versatile Kinetics Demonstration
Ruda, P. T.
J. Chem. Educ. 55 ,652 (1978)
Oxidation of tartaric acid by 6% H_2O_2 in the presence of cobalt chloride catalyst. Complex formation; interpretation as "activated complex" is questionable.

*PHYS COLLOID FLUOR MICELLE UVIS 3

Determination of Critical Micelle Concentration Using Acridine Orange Dye Probe
Rujimethabhas, M.; Wilairat, P.
J. Chem. Educ. 55 ,342 (1978)
In or near region of CMC of sodium dodocyl sulfate, there is a sharp change in fluorescence and an interpretable change in absorbance of the solution.

*PHYS APPARATUS GAS VACTEK VISC 3

A Simple Gas Viscosity Experiment
Salzberg, H. W.
J. Chem. Educ. 42 ,663 (1965)
Viscosities of common lab gases measured by flow thru capillary on vac line apparatus; ideal gas law; Poiseuille's eqn; pressure measurement.

*PHYS ORD STEREO STRUCT UVIS 4 HAZARD

An Experiment in Optical Rotatory Dispersion
Schelz, J. P.; Purdy, W. C.
J. Chem. Educ. 41 ,645 (1964)
Optical rotary dispersion accessory with recording ultraviolet spec. Sol'ns of androsterone in dioxane prepared at various concentrations for calibration curve. HAZARD: dioxane - carcinogen

*PHYS POLYMER DEMO THERMO 2

Demonstration Tests
Schmulbach, C. D.; Ahmed, I. Y.
J. Chem. Educ. 53 ,775 (1976)
Tests (exams) in lecture utilize demos performed during exams as scenarios for exam questions. Illustrated with then familiar "thermodynamics of a rubber band". A tested demonstration.

*PHYS BIOCHEM KIN UVIS 3

The Hydrolysis of P-Nitrophenyl Beta-Glucoside: An undergraduate experiment
Schram, A. C.
J. Chem. Educ. 56 ,351 (1979)
Basic hydrolysis from colorless glucoside to intensely colored p-nitrophenolate ion followed spectrophotometrically. Concentration and temperature dependence measured. Caution: 5N NaOH causes skin burns.

*PHYS ORG ACBA KIN TITN 3 HAZARD

Determining a Reaction Rate Constant: An organic laboratory experiment
Schreck, J. O.
J. Chem. Educ. 43 ,149 (1966)
Reaction of methyl iodide and potassium t-butoxide followed by removal of aliquots for analysis by acid-base titration. HAZARD: HClO4 is a storage and disposal hazard. Suggest use HCl.

*PHYS ORG ACBA KIN 3

An Example of Following Second-Order Kinetics by Simple Laboratory Means
Schreiber, G.
J. Chem. Educ. 53 ,664 (1976)
Hydrolysis of ethylene bromohydrin (BrCH2CH2OH) in alkaline medium. A fixed conc. of hydroxide is used with varied but large excess conc. of the bromhydrin together with an acid base indicator. The time measured to the color change is used to follow the reaction. No proof that it is second order, but only it is first order in bromohydrin.

*PHYS ASSOC COLLIG OSMOSIS VAPORPRESS 3 HAZARD

Intermolecular Association by Vapor Pressure Osmometry
Schrier, E. E.
J. Chem. Educ. 45 ,176 (1968)
Caprolactam and N-butylacetamide have different patterns of H-bonding. Measurement of vapor pressures of dilute solutions allows calculation of association constants and schemes (discussed). HAZARD: benzene, solvent, is carcinogen.

*PHYS ASSOC DENSITY DIPOLE 3

Intermolecular Association and Molar Polarization: Physical chemistry experiment
Schrier, E. E.
J. Chem. Educ. 43 ,257 (1966)
Dielectric constant and density measured, used to calculate molar polarizations at various concentrations. Changes with concentration for caprolactam and N-methylacetamide differ because of different association patterns.

*PHYS FLUOR PHOSPHOR QUANTUM VIS 4

Room Temperature Phosphorescence: An Experiment for the Undergraduate Physical or Analytical Laboratory
Schulman, E. M.
J. Chem. Educ. 53 ,522 (1976)
Phosphorescence of various materials on rigorously dried filter paper, using room temperature spectrophosphorimeter. Excitation and emission spectra for 16 phosphors given. Delayed fluorescence, singlet-triplet splitting in relation to charge.

*PHYS ELECTROCHEM THERMO 3

Entropy of Mixing - An Electrochemical Measurement
Selley, N. J.
J. Chem. Educ. 49 ,212 (1972)
Cell potentials for hexacyanoferrates (II and III) at varying conc. ratios, plotted against ratio. Area under curve is work of mixing.

*PHYS COMPUTER NMR QUANTUM 4

Calculation of Complex NMR Spectra in the Undergraduate Laboratory
Seyse, R. J.; Pearce, H. L.; Rose, T. L.
J. Chem. Educ. 52 ,194 (1975)
Tetraethyltin. Varian HA-100 NMR. Experimental and calculated (by LCAON3) spectra.

*PHYS APPARATUS GC PHASE VACTEK 3 HAZARD

Liquid-Vapor Equilibrium at Constant Temperature
Shearer, E. C.
J. Chem. Educ. 50 ,446 (1973)
Simple equipment: vacuum pump, mercury manometer, sample vessel and gas sampling. Systems studied include acetone-ether, acetone-chloroform; GC used to analyze both vapor and liquid composition rather than refr. index. Several liquid pairs suggested. HAZARD: CHCl3 is a suspected carcinogen.

*PHYS ORG KIN PREP UVIS 3

Hydrolysis of Benzenediazonium Ion: An experiment in first-order kinetics
Sheats, J. E.; Harbison, K. G.
J. Chem. Educ. 47 ,779 (1970)
Rate of decomposition of benzenediazonium fluoroborate (prepared, stable) by quenching via coupling unreacted ion with 2-naphthol-3,6-disulfonic acid (disodium salt) giving an orange azo compound, max. abs. 490 nm.

*PHYS APPARATUS CALORIMETRY CRYO STATISTICS THERMO VACTEK 4

The Heat Capacity of Metals: A physical chemistry experiment
Shigeishi, R. A.
J. Chem. Educ. 56 ,59 (1979)
Statistical mechanics discussed. 3rd year Honors course, 3 periods. 77-300 K. Einstein and Debye theories. Emphasis is on the apparatus.

*PHYS CLOCK KIN REDOX 3

The Kinetics of an Ionic Reaction: A physical chemistry experiment
Shurvell, H. F.
J. Chem. Educ. 44 ,577 (1967)
Oxidation of iodide by H_2O_2 in acid sol'n. Rates measured by internal aliquots of std. thiosulfate starch. (Iodine-clock).

*PHYS CLOCK KIN 3

The Activation Energy of an Ionic Reaction: A physical chemistry experiment
Shurvell, H. F.
J. Chem. Educ. 43 ,555 (1966)
Iodine-clock modified to give activation energy by rates at different temperatures.

*PHYS GAS VAPORPRESS 2

A Pseudo-Charles' Law Experiment to Teach Vapor Pressure Concepts
Sinclair, D. L.
J. Chem. Educ. 46 ,814 (1969)
Using water as a confining liquid for air in a Charles' law experiment gives misleading results - for students to explain.

*PHYS DEMO KIN SOLUB 1

Effect of Temperature on Reaction Rate.
Siwon, J.
J. Chem. Educ. 49 ,A85 (1972)
Rate of solution of aluminum in 10M HCl increased as temp. increases. A Chem. Ed. Tested Demo.

*PHYS AVOGADRO COLLOID MICROSCOPE 3

Determination of Avogadro's Number by Perrin's Law
Slabaugh, W. H.
J. Chem. Educ. 42 ,471 (1965)
Perrin's method. Gum Gamboge; centrifuge at 1500 rpm to monodisperse suspension. Slide prep'n and observation on vertical stage of microscope; uses a calibrated-grid reticle for counting particles. Two-week exp't.

*PHYS AVOGADRO REVIEW 2

Avogadro's Number by Four Methods
Slabaugh, W. H.
J. Chem. Educ. 46 ,40 (1969)
Particle distribution in gamboge suspension (Perrin); electroplating Cu and Ag, oleic acid monolayer on water, electrolysis of water compared.

*PHYS APPARATUS GAS NOPROC PHOTO VACTEK 4

Determination of Molecular Diameters by the Use of the Crookes Radiometer: An undergraduate experiment
Smith, J. H.
J. Chem. Educ. 47 ,590 (1970)
Uses toy radiometer (or one constructed), vac. manifold.. Pirani gauge, ir lamp; complicated kinetic theory of gases.

*PHYS APPARATUS ELECTROCHEM KIN NOPROC 4

A Kinetic Experiment Using Potentiometric Determination of Reactant Concentration
Smith, R. H.
J. Chem. Educ. 50 ,441 (1973)
Oxidation of formate and oxalate with bromine followed potentiometrically (Br_2,Br - redox). 6-9 hrs lab time or project.

*PHYS DEMO SOLUB 2 HAZARD

Selective Solubility: "Like Dissolves Like"
Smith, W. L.
J. Chem. Educ. 54 ,228 (1977)
Azobenzene dissolves in CCl_4 (but not in water) to give a bright orange solution. Simple. A tested demonstration. HAZARD: CCl_4 (carcinogen).

*PHYS ORG KEQ KIN NMR 5

Kinetic Study by NMR
Socrates, G.
J. Chem. Educ. 44 ,575 (1967)
Hydration of pyruvic acid, equilibrium first measured by NMR integ. Kinetics by line broadening.

*PHYS VISC 2

Liquid Viscosity Measurement Using a Buret: An instructional technique
Sorrell, C. A.
J. Chem. Educ. 48 ,252 (1971)
Simple method for measuring viscosities of relatively low viscosity liquids such as water, acetone, etc. Requires calibration with several known liquids, and good temperature control is very difficult.

*PHYS ORG IR KEQ 4 HAZARD

Spectrophotometric Determination of an Equilibrium Constant
Spencer, J. N.
J. Chem. Educ. 50 ,298 (1973)
H-Bonding of methanol-ether in CCl4 measured 2650-2950 nm. Recording spectrophotometer. HAZARD: CCl4 is a carcinogen, can be avoided.

*PHYS ORG NMR 4

CINDP Experiment Using a Permanent Magnet NMR
Spencer, T S.; O'Donnell, C. M.
J. Chem. Educ. 50 ,152 (1973)
Nuclear Overhauser effect. NMR spectra of free radicals formed from n-butyllithium with 2-iodopropane.

*PHYS THERMO UVIS 4

Heat of Vaporization of Iodine Using Absolute Entropy Data: A physical chemistry experiment
Stafford, F. E.
J. Chem. Educ. 40 ,249 (1963)
Iodine crystals placed in 10-cm absorption cell and allowed to equilibrate at various temp. Beer's Law plot. Combined Keq and third law tabulated (and calculated) delta-S gives delta-H.

*PHYS COMPUTER MOL.SPECT UVIS 4

Band Spectra and Dissociation Energies: A physical chemistry experiment
Stafford, F. E.
J. Chem. Educ. 39 ,626 (1962)
Visible spectra of gaseous Br2, I2 recorded (1 period). Complicated calculations (computer program available) give dissociation energies, vibrational levels. Two to three periods for calc.

*PHYS IR MOL.SPECT QUANTUM 4

Vibration-Rotation Spectrum of HCl: A physical chemistry experiment
Stafford, F. E.; Holt, C. W.; Paulson, G. L.
J. Chem. Educ. 40 ,245 (1963)
Much theory discussion and help in interpreting data. Cary 14.

*PHYS MOL.SPECT UVIS 3

Atomic Spectra: A physical chemistry experiment
Stafford, F. E.; Wortman, J. H.
J. Chem. Educ. 39 ,630 (1962)
Sodium (best), potassium, or hydrogen spectrum recorded Cary Model II, analyzed for sharp, principal and diffuse spectra series limits and ionization potentials.

*PHYS FLUOR MOL.SPECT 4

A Molecular Fluorescence Experiment for undergraduate physical chemistry
Steinfeld, J. I.
J. Chem. Educ. 42 ,85 (1965)
Quartz mercury arc, spectrograph, film recording. Iodine fluorescence; std. neon spectrum.

*PHYS ANAL INORG BIOCHEM COURSE NOPROC PROJ RADIOCHEM 2

A Chemistry Projects Laboratory
Steinfeld, J. I.
J. Chem. Educ. 46 ,232 (1969)
Project used at MIT in place of required general chemistry lab includes many different techniques.

*PHYS ACBA KEQ PH TITN 2

Determination of pKa Using the Half-Volume Method: A Laboratory Method
Stephens, S. J.; Joncich, M. J.
J. Chem. Educ. 54 ,711 (1977)
Classical method for simultaneous titrimetric determination of pKa and m.wt. of weak monoprotic acids. ("Method of half-neutralization").

*PHYS CALORIMETRY THERMO 4 HAZARD

The Determination of the Resonance Energy of Benzene: A physical chemistry laboratory experiment
Stevenson, G. R.
J. Chem. Educ. 49 ,781 (1972)
Parr oxygen-bomb calorimeter. This is the now classic experiment included in many courses where the resonance energy of benzene is calculated from the heats of combustion of benzene and cyclooctatetraene. Hazard: benzene is a carcinogen.

*PHYS ANAL APPARATUS ELECTROANAL KIN 3

A Simple Low-Current Potentiostat Coulometric Analysis: The Hydrolysis of Benzoyl Chloride
Stock, J. T.
J. Chem. Educ. 45 ,736 (1968)
Circuit diagrams for potentiostat and power supply. Coulometric analysis for 2,2-dinitropropane given in detail.

*PHYS APPARATUS ELECTROCHEM KIN 3

A Stabilized Direct-Reading Conductance Apparatus
Stock, J. T.
J. Chem. Educ. 44 ,573 (1967)
Circuit diagram and details of micro cell construction.. Use for measuring rate of hydrolysis of benzoyl chloride. Kinetics at two temperatures gives activation energy.

*PHYS APPARATUS FASTREACTION FLASHPHOTOL KIN 4

Direct Studies of Atomic Reactions in the Undergraduate Laboratory: Time Resolved Atomic Absorption Spectroscopy
Stock, M. G.; Little, D. J.; Donovan, R. J.
J. Chem. Educ. 51 ,51 (1974)
Apparatus described for flash photolysis of methyl iodide to yield iodine atoms,in the first excited state. Decay of this state followed on oscilloscope. Decay is first order in I.

*PHYS ORG KIN PHARM UVIS 2 3

The Hydroxylaminolysis of Penicillin G.: A kinetic experiment
Stuckwisch, C. G.
J. Chem. Educ. 49 ,539 (1972)
Penicillin reacts with hydroxylamine to yield a hydroxamic acid. This gives a colored complex with Fe+3; reaction can be followed spectrophotometrically

*PHYS ORG HEAT KIN NMR 3

Solution Pyrolysis Kinetics Utilizing NMR Spectra
Stump, B. L.; Ottenbrite, R. M.; Brockington, J. W.
J. Chem. Educ. 53 ,257 (1976)
Decomp. of 1,1-diphenylpropyl hydrogen phthalate in DMSO is 1st order and can be followed by nmr techniques. Determinations at 65, 75, 80 and 92 degrees C, by nmr after quenching. Straightforward. Extensions to synthesis suggested.

*PHYS APPARATUS BIOCHEM DENSITY THERMO 4

The Determination of Partial Specific Volume: A physical chemistry experiment
Sun, S. F.; Serpentino, P. M.
J. Chem. Educ. 51 ,552 (1974)
Crystalline bovine serum is dissolved in 0.1M KCl. Special pycnometers. Simple, accurate method gives data suitable for molecular weight det'n.

*PHYS APPARATUS DENSITY GAS 3

Semi-Micro Vapor Density Apparatus
Svec, H. J.; Peterson, N. C.
J. Chem. Educ. 42 ,336 (1965)
Simple glass apparatus and technique, using 15 microliters. Requires glass-blowing.

*PHYS KIN OSC.RXN 4

Oscillations in the Iodate-Mn^{++} System: Apparent Energy of Activation
Swamy, C. S.; Doss, K. S. G.
J. Chem. Educ. 56 ,321 (1979)
Monitor frequency of oscillation by color change or oscillation of pH meter. Plot of -log t vs 1/T is a straight line.

*PHYS COMPUTER STATISTICS TECHNIQUE 4

Determination of the Nyquist Frequency: A computer-interfacing experiment
Swanson, R.; Thoennes, D. J.; Williams, R. C.; Wilkins, C. L.
J. Chem. Educ. 52 ,530 (1975)
Exp't. illustrates parameters in analog to digital conversions of meaningful data. Sampling theory. Requires real-time BASIC, digital to analog converter, computer controlled clock, analog to digital converter.

*PHYS KIN TECHNIQUE 4

Relaxation Kinetics: An experiment for physical chemistry
Swinehart, J. H.
J. Chem. Educ. 44 ,524 (1967)
Study of chromate-dichromate equilibrium by mixing small amounts of conc. $CrO_4^{=}$-$Cr_2O_7^{=}$ solution into larger volume of a more dilute solution containing an indicator. pH change resulting from perturbation monitored spectrophotometrically at indicator absorption maximum.

*PHYS ORG KIN TITN 4

A Second Order Kinetics Experiment
Teerlink, W. J.; Asay, J.; Sugihara, J. M.
J. Chem. Educ. 41 ,161 (1964)
Samples of NaI and ethyl p-toluenesulfonate reacted at const. temp. At intervals, reaction is quenched and titrated with $AgNO_3$-eosin. Data plotted to yield 2nd order rate constant.

*PHYS DEMO ELECTROCHEM 2

Electrolytic Conductivity: A Demonstration Experiment
Thomas, B.
J. Chem. Educ. 39 ,531 (1962)
Ohm's Law approach. Circuit incorporates vacuum tube voltmeter, milliammeter. Results given for 12 test solutions.

*PHYS COLLOID UVIS 4

A Light Scattering Experiment for Physical Chemistry
Thompson, A. C.; Kozimer, K. G.; Stockwell, D. G.
J. Chem. Educ. 47 ,828 (1970)
Light-scattering experiments with commercial colloidal silica sols. Turbidity measurements at different wavelengths allow det'n of particle diameters.

*PHYS ELECTROCHEM 1

Charge and Mass of the Electron: An introductory experiment
Thompson, C. C.
J. Chem. Educ. 50 ,435 (1973)
Obs. of time, current, weight change at electrodes in Cu, Pb or Ni coulometers allows calc'n of charge of an Avogadro number of electrons. Mass is from e:m ratio, given, not determined.

*PHYS ORG PHOTO UVIS 3 HAZARD

Photo-Oxidation of Leuco Methyl Crystal Violet: A physical chemistry experiment
Thyrion, F. C.
J. Chem. Educ. 48 ,766 (1971)
LCMV sol'n in ethanol irradiated at 590 nm. with and without CCl_4 sensitizer. HAZARD: CCl_4 and asbestos sheeting (around light source) are carcinogens; protect eyes from UV radiation. Requires double beam spectrophotometer. Extensions.

*PHYS ORG ELECTROCHEM KIN NOPROC 3

Determining Second Order Rate Constants
Tobey, S. W.
J. Chem. Educ. 39 ,473 (1962)
Alkaline hydrolysis of phenyl m-nitrobenzoate by a conductimetric technique. Original (by the authors, not otherwise described, in journal literature) treatment of data.

*PHYS ANAL ACBA INSTR KEQ MOL.SPECT PH 3

The Acid Dissociation Constant of Methyl Red: A spectrophotometric measurement
Tobey, S. W.
J. Chem. Educ. 35 ,514 (1958)
Beckman B spectrophotometer, pH meter. Straightforward.

*PHYS APPARATUS PHASE VAPORPRESS 3 HAZARD

Ideal Solution Laws: Apparatus and experiment
Tobey, S. W.
J. Chem. Educ. 39 ,258 (1962)
Raoult's law proved. Apparatus requires some glassblowing. Organic liquid mixtures heated under slight pressure presents a flammability HAZARD.

*PHYS COORD KIN 2

Aquation of Tris-(1,10-phenanthroline) Iron(II) in Acid Solution: A kinetics experiment
Twigg, M. V.
J. Chem. Educ. 49 ,371 (1972)
Rate of decay of color of ferrous-phenanthroline complex in dilute mineral acids followed at 510 nm. First order. Temperature dependence gives activation energy.

*PHYS ORG NMR TECHNIQUE 4

Experimental Determination of the Nuclear Overhauser Effect
VanAntwerp, C. L.
J. Chem. Educ. 50 ,638 (1973)
NOE enhancement measurement. Varian T-60, vacuum line.
3,3-dimethylacrylic acid, TMS, low magnetic solvent, etc.

*PHYS ELECTROCHEM 2

Coulometry: A series experiment
VanLente, K. A.
J. Chem. Educ. 43 ,306 (1966)
Comparison between a silver coulometer, an iodine, and a gas coulometer.

*PHYS ORG CRYSTAL INTEGR MICROSCOPE PREP 3

Liquid Crystals - Synthesis and Properties: An experiment for the integrated organic and physical laboratory
Verbit, L.
J. Chem. Educ. 49 ,36 (1972)
Explicit directions for prep'n of cholesterol benzoate and p-methoxybenzylidene p-N-butylaniline. Two optical exp'ts, use polarizing microscope and conducting glass.

*PHYS ORG KIN PHOTO UVIS 3

An Experiment to Determine a Photochemical Quantum Yield
Vernon, A. A.; Forbes, G. S.
J. Chem. Educ. 34 ,350 (1957)
Comparison of the rates of photolysis of malonic and oxalic acids. An oxalic acid-uranyl ion solution is used as the actinometer. 45 minute exposure to 8-watt germicidal lamp. Permanganate titrations.
Caution: uranium compounds are radioactive.

*PHYS ELECTROCHEM ELECTRODE THERMO 3

Thermodynamic Parameters From an Electrochemical Cell
Vincent, C. A.
J. Chem. Educ. 47 ,365 (1970)
Prep'n of a calomel electrode given explicitly, and prep'n of Ag-AgCl electrodes described. This cell allows measurement of temp. coefficient of emf.

*PHYS ORG DEMO PHASE 1 2 HAZARD

Organic Eutectic Mixtures
Viswanathan, A.
J. Chem. Educ. 37 ,A36 (1960)
A Chem-Ed Tested Demo. Four pairs of compounds, solid at room temp. melt on being mixed together, with a lowering of the temperature.
HAZARD: some of the organics listed are now known to be carcinogens (such as alpha-naphthylamine). The author suggests that other pairs can found on p. 177 of the International Critical Tables, Volume 4 (1928).

*PHYS CRYO 2

Salt Cryoscopy
Wale, C. L.
J. Chem. Educ. 48 ,539 (1971)
A better version of the "lowering of the freezing point" experiment than is usual in most Gen. Chem. Labs. Uses thick-walled vessel, semimicro Beckmann thermometer or thermistor, thermostat, rapid stirring device. Expt is to find mwt of an unknown by depression of transition point of Na2SO4.

*PHYS APPARATUS COLLIG GLOVEB 5

Determination of the Molecular Weight of Air-Sensitive Compounds
Walker, F. W.; Ashby, E. C.
J. Chem. Educ. 45 ,654 (1968)
Apparatus and procedure for mol. wt. by boiling pt. elevation under nitrogen. Elaborate apparatus for sensitive compounds, eg. Grignard solutions. Most useful in research.

*PHYS DIFFUSION 3

Diffusion in Liquids: A class experiment
Watts, H.
J. Chem. Educ. 39 ,477 (1962)
KCl in agar in test tubes with open end in water. Diffusion coefficients calculated from change in KCl conc. (avg.) in gel with time (one week).

*PHYS ESR QUANTUM TECHNIQUE 4

ESR Studies of Hyperfine Interactions in DMSO-H2O Solutions: A Physical chemistry experiment
Watts, M. T.; Vanreet, R. E.; Eastman, M. P.
J. Chem. Educ. 50 ,287 (1973)
Simple ESR measurements of the 14-N hyperfine splitting of the ditertiarybutyl nitroxide radical in DMSO-H2O solution, used to confirm strong DMSO-H2O interactions. DTBN purchased or synthesized (ref.).

*PHYS DEMO ELECTROCHEM MOLTENSALT 1

Conductivity of Fused Salts
Weaver, E. C.
J. Chem. Educ. 35 ,A60 (1958)
A Chem-Ed Tested Demo. The fused salt is semi-liquid soft glass.

*PHYS ANAL ORG CALORIMETRY CATALYSIS KIN 3

A Thermoanalytical Kinetic Experiment: The Catalyzed Reaction of Phenyl Isocyanate With Butanol
Weisfield, L. B.
J. Chem. Educ. 38 ,88 (1961)
Simple equipment. Rate constant graphically from temperature-time plot. Method not useful if heat of solution is comparable to heat of reaction.

*PHYS APPARATUS DTA KIN 3

Reaction Kinetics by Differential Thermal Analysis
Wendlandt, W. W.
J Chem Educ 38 ,571 (1961)
Furnace constructed, also temperature controller, amplifier. All could be purchased. Curves in air and in helium differ because of CO + O2 yielding CO2. Kinetics from graphs with approximations. NaHCO3, CaC2O4.H2O.

*PHYS CHARGETRANS COMPLEX PROJ UVIS 3

Molecular Charge Transfer Complexes: A group experiment in physical chemistry
Wentworth, W. E.; Drake, G. W.; Hirsch, W.; Chen, E.
J. Chem. Educ. 41 ,373 (1964)
Tetracyanoethylene complexes with benzene and methyl benzenes measured (375 - 550 nm) with recording spectrometer. Extensive theory discussion.

*PHYS ANAL EDTA KSP NOPROC SOLUB TITN 3

The Effects of Chloride Ion and Temperature on Lead Chloride Solubility: A versatile quantitative experiment
West, A. C.
J. Chem. Educ. 46 ,773 (1969)
Pb+2 by titr. EDTA with xylenol orange. 3 lab periods

*PHYS APPARATUS GAS KEQ PHOTO THERMO VACTEK 3 HAZARD

A Photometric Study of the N2O4-NO2 System: A physical chemistry experiment
Wettack, F. S.
J. Chem. Educ. 49 ,556 (1972)
Special cell on vac. system, mercury lamp, phototube. Only NO2 absorbs at 500-600 nm. Pressure and temperature varied. Good pedagogically as brown gas allows student to see results of gas handling by vacuum techniques. HAZARD: NO2 is highly toxic.

*PHYS COMPUTER FLUOR PHOTO UVIS VACTEK 4

Vibronic Energy Transfer: A physical chemistry experiment
Wettack, F. S.; Bibart, C. H.
J. Chem. Educ. 48 ,126 (1971)
Fluorescence quenching of benzene by added gases. Diagram of vac. and optical systems. Data taken is amps photocurrent vs. pressure. Collision cross-sections calculated. Monochromator, mercury source, photomultiplier, microammeter. Caution: benzene (in vacuum system) is a carcinogen.

*PHYS INORG COORD KIN PREP UVIS 3

A Kinetics Experiment for the Physical Chemistry Laboratory
Whitaker, R. D.
J. Chem. Educ. 40 ,264 (1963)
Rate of step-wise diss'n of nickel-o-phenanthroline complex, Ni(o-phen)3, followed spectrophotometrically at 420 nm and at different temp. Directions for prep'n of complex given.

*PHYS ANAL ACBA KEQ PH TITN

Conjugate Acid-Base Mixtures in the General Chemistry Laboratory: A comprehensive buffer experiment
Wiger, G. R.; DelaCamp, U. U.
J. Chem. Educ. 55 ,401 (1978)
Students are led to derive buffer relationships by experiments.

*PHYS ANAL APPARATUS IONSELECT MOLTENSALT 4 HAZARD

Ion Specific Electrodes in Fused Salts
Wilcox, F., Sr.
J. Chem. Educ. 52 ,123 (1975)
Prep'n of glass-membrane ion-sel. electrodes and use in various nitrate melts described. Furnace construction given. HAZARD: protect all nitrate melts from contact with carbon-containing compounds. Serious explosive hazard. Refer: Janz & Allen, J. Hazardous Materials, 1981.

*PHYS COORD ELECTROANAL PH TITN 4 HAZARD

The Uranyl-Acetate System Studied by pH Potentiometry
Williams, D. R.
J Chem. Educ. 48 ,480 (1971)
Acetate acts as a bidentate ligand in this system. Pye-Ingold titration vessel (air-tight, const. temp.). HAZARD : HClO4 - storage hazard.

*PHYS ACBA KEQ PH 3

Molecular Weight Determination of Weak Acids
Wilson, S. A.; Weber, J. H.
J. Chem. Educ. 54 ,513 (1973)
Uses virial equation for calcn mwts from known Ka and measured pH for mono- and dibasic acids. Exptl data given for tartaric acid; results for other acids. Bibliographers suggest this is an unrealistic expt.

*PHYS PHASE 2 HAZARD

A Eutectic Experiment: For general chemistry laboratory
Wise, J. H.; Shillington, J. K.; Watt, W. J.; Whitaker, R. D.
J. Chem. Educ. 41 ,96 (1964)
Biphenyl-naphthalene. Straightforward, one lab period, used in several texts. Hazard: naphthalene is a suspected carcinogen.

*PHYS INORG COMPLEX KEQ 3

Two Student Experiments on Chemical Equilibrium
Wolfenden, J. H.
J. Chem. Educ. 36 ,490 (1959)
Practical exam. Titrimetric exp't (student to plan most of experiment) to det'n formula of Ag^{+}-NH3 complex. Similar, but more difficult, exp't to det'n Ksp of silver acetate.

*PHYS VAPORPRESS 2

Determination of Vapor Pressure
Wolthius, E.; Brummel, R.; VandenBout, P.
J. Chem. Educ. 36 ,494 (1959)
Simple apparatus described for determination of v.p. by a distillation technique.

*PHYS CALORIMETRY THERMO 2

Heat of Reaction and H2SO4 Concentration
Wolthuis, E.; Leegwater, A.; VanderPloeg, J.
J. Chem. Educ. 38 ,472 (1961)
A pint-sized thermos bottle was used as the calorimeter initially, but later the exp't was performed using a 100-ml beaker insulated by vermiculite, etc. The heat produced by dilution of an unknown H2SO4 solution when diluted with H20, is used to det'n the conc. of the acid, given a calibration curve that shows the temperature rise when 5 ml std acid is diluted with water.

*PHYS INORG PHASE SOLUB 2

Determination of Solubility: A laboratory experiment
Wolthuis, E.; Pruiksma, A. B.; Heerema, R. P.
J. Chem. Educ. 37 ,137 (1960)
Explicit instructions for solubility determination over range 20-100 deg. C by observation of saturation temperatures. Data given for some typical salts. Used at Stony Brook - works well.

*PHYS APPARATUS COLLIG 2 HAZARD

Molecular Weight Determination by Boiling-Point Elevation
Wolthuis, E.; Visser, M.; Oppenhuizen, I.
J. Chem. Educ. 35 ,412 (1958)
Simple apparatus used to det. the molecular weight of p-dichlorobenzene, p-dibromobenzene, biphenyl, and naphthalene from the elevation of the boiling point of carbon tetrachloride. The following are HAZARDS (carcinogens): p-dichlorobenzene, naphthalene and carbon tet.

*PHYS ORG APPARATUS IR MOL.SPECT 4

Infrared Spectroscopic Studies of Hindered Internal Rotation: A physical chemistry experiment
Woodward, A. J.; Jonathan, N.
J. Chem. Educ. 46 ,756 (1969)
Low-temp IR. 1,2-dichloroethane, etc. Gas cell, special cell and sample holder: construction given for low temp. liquid and solid.

*PHYS DISTRIB PHASE UVIS 3

Calculation of Activity Coefficients From Spectroscopic Data: A physical chemistry experiment
Worley, J. D.; Fussaro, D. R.
J. Chem. Educ. 45 ,534 (1968)
p-Xylene-dodecane-H2O system. Analysis of aq. layer for p-xylene by measuring absorption at 274 nm.

*PHYS APPARATUS FLASHPHOTOL GAS KIN 4

Recombination of Iodine Via Flash Photolysis: A chemical kinetics experiment in physical chemistry
Yamanashi, B. S.; Nowak, A. V.
J. Chem. Educ. 45 ,705 (1968)
Straightforward, but uses special apparatus. 3-4 lab periods.

*PHYS ELECTROCHEM ERROR FASTREACTION IONX KIN 3

An Amperometric-Kinetic Experiment Emphasizing the Importance of Error Treatment
Young, J. A.; Zeto, R. J.
J. Chem. Educ. 35 ,146 (1958)
Study of the hydrolysis of nitroethane. Both pH and current values are recorded. Directions for setting up apparatus (readily available equipment).

*PHYS DEMO DENSITY GAS 2

Determination of the Molar Volume of a Gas at Standard Temperature and Pressure: A lecture demonstration
Zaborowski, L. M.
J. Chem. Educ. 49 ,361 (1972)
A balloon experiment. Best as a demo but could be individual. Simple apparatus.

*PHYS CALORIMETRY THERMO 3 HAZARD

The Heat of Mixing of Organic Liquids
Zaslow, B.
J. Chem. Educ. 37 ,578 (1960)
Calorimetry of CH3Cl-CCl4, CCl4-acetone, and CHCl3-acetone systems gives info. on hydrogen bond. Dewar flask calorimeter. HAZARD: all systems now suspected carcinogens.

*PHYS ACBA TITN 1

Laboratory Group Exercises in Acid-Base Theory
Zuehlke, R. W.
J. Chem. Educ. 39 ,354 (1962)
Students measure pH of indicator change, use different indicators to find pH of various NaOH/HCl and NaOH/HOAc mixtures. Class results simulate a titration.

*POLYMER PHYS IR PHOTO 4

Polymer Photooxidation: An Experiment to Demonstrate the Effect of Additives.
Allen, N. S.; McKeller, J. F.
J. Chem. Educ. 56 ,273 (1979)
Effect of 2-hydroxy-4-octyloxybenzophenone (an additive) incorporated by solvent blending or melt on the photooxidation of polypropylene (commercial, no additives) monitored by infrared spectroscopy, abs. at 1710 recip. cm, ie. by carbonyl index method.

*POLYMER PHYS PHOTO VISC 4

An Introduction to Photoelectrolytes Via the Physical Chemistry Laboratory
Ander, P.
J. Chem. Educ. 56 ,481 (1979)
A study of the interaction of sodium polystyrenesulfonate with two conc. of aq. NaCl. Polyelectrolytes are usually coiled in solution. Viscometry is used to determine the change in coiling due to change in counterion conc. Discussion invokes Debye-Huckel and Manning polyelectrolyte theories.

*POLYMER PHYS CATALYSIS PREP VISC 3 HAZARD

Dependence of Molecular Weight of Polystyrene on Initiator Concentration: An introductory physical chemistry experiment
Ander, P.
J. Chem. Educ. 47 ,233 (1970)
Distilled styrene polymerized with varying amounts of benzoyl peroxide. Viscosity measured, Ostwald or Ubbelhode visc. HAZARD: benzoyl peroxide, sealed tubes.

*POLYMER PHYS DEMO THERMO 4

Stress-Strain Behavior of Rubber
Arends, C. B.
J. Chem. Educ. 37 ,41 (1960)
Some observations on the phenomena surrounding toy balloons as used to explore PVT phenomena. An unusual (photographic) technique is used to study the inflation characteristics of cylindrical balloons.

*POLYMER ORG PREP 3

Acid Hydrolysis of Nylon 66
Berkowitz, W. F.
J. Chem. Educ. 47 ,536 (1970)
2 lab periods. Recovery of adipic acid and benzenesulfonate of the diamine. Study questions.

*POLYMER DEMO PREP 2 HAZARD

Improving the Nylon Rope Trick
Bieber, T. I.
J. Chem. Educ. 56 ,409 (1979)
Modification including concentration changes and stirring gives a rope with enough wet strength to resist breaking during the demo.
HAZARD: 1,6-diaminohexane, sebacoyl chloride.

*POLYMER CRYSTAL DEMO MICROSCOPE 1

Growth and Observation of Spherulites in Polyethylene
Billmeyer, F. W.; Geil, P. H.; VanDerWeg, K. R.
J. Chem. Educ. 37 ,460 (1960)
From a science fair project. Polarizing microscope would be most effective for watching the growth of the crystals, observing the extinction patterns, etc., but an ordinary microscope and two pieces of "polaroid" will serve.

*POLYMER PHYS DEMO PHOTO PHOTORES 2 3

Polymer Photophysics: A Negative Photoresist
Bramwell, F. P.; Zadjura, R. E.; Stemp, L.; Farenholtz, S. R.
Flowers, J. M.
J. Chem. Educ. 56 ,541 (1979)
Photoresist is made by depositing polyvinyl cinnamate from methylene chloride soln on a glass slide, preferably by spin-casting. After placing the object on the slide and exposure to uv, the slide is developed with cellosolve acetate. A simple spin-casting apparatus based on a student centrifuge for ensuring uniformity in the film is described. Polyvinyl cinnamate may be purchased or prepared.

*POLYMER CATALYSIS PREP 3 HAZARD

Synthesis of Poly(Beta-Alanine) and Beta-Alanine
Carraher, C. E., Jr.
J. Chem. Educ. 55 ,668 (1978)
Prep'n of poly(beta-alanine) by treating acrylamide with a catalytic amount of a solution of metallic sodium in xylene under N2.
Polymerization is a self (Michael) addition. The product is hydrolysed in acid solution to beta-alanine.
HAZARD: Acrylamide is toxic and sodium dispersions are dangerous.

*POLYMER PREP VISC 4

Generation of Poly(vinyl Alcohol) and Arrangement of Structural Units.
Carraher, C. E., Jr.
J. Chem. Educ. 55 ,473 (1978)
Deacylation of polyvinyl acetate by KOH in methanol to polyvinyl alcohol. This is then degraded by exposure to periodic acid. Extent of cleavage is followed by viscometry, and measures proportion of 1,2-diol structures.

*POLYMER ORG NAME PREP 3

Synthesis of Furfuryl Alcohol and Furoic Acid
Carraher, C. E., Jr.
J. Chem. Educ. 55 ,269 (1978)
Furfuryl alcohol and furoic acid are prepared from furfural (Cannizzaro). A ureaformaldehyde resin is prepared as a plywood adhesive using furfuryl alcohol as additive.

*POLYMER ORG NAME PREP 3 HAZARD

Synthesis of Caprolactam and Nylon 6
Carraher, C. E., Jr.
J. Chem. Educ. 55 ,51 (1978)
Synthesis of caprolactam from cyclohexone oxime (Beckman rearrangement) and prep'n of Nylon-6 by reaction with catalytic amounts of sodium hydride + N-actylcaprolactum.
HAZARDS: (1) Molten nylon can react explosively with oxygen; (2) lachrymators and skin irritants used; (3) sodium hydride.

*POLYMER CATALYSIS PREP SURFACE 2

Emulsion Polymerization and Film Formation of Dispersed Polymeric Particles
Ceska, G. W.
J. Chem. Educ. 50 ,767 (1973)
Sodium lauryl sulfate (surfactant), ammonium persulfate (initiator), styrene and butyl acetate (monomers). Requires N2 sweep, drying oven. Caution: pop bottles are made of flint glass, and are considered hazardous in instructional labs.

*POLYMER STATISTICS 3

Linear Polymers and Statistics: A Laboratory Experiment
Dole, M.
J. Chem. Educ. 32 ,202 (1955)
Toy roulette wheel, pegs and numbered tetrahedral balls used to simulate molecular weight distributions.

*POLYMER PHYS DEMO THERMO 2

Lecture Table Demonstration of Entropy
Dole, M.
J. Chem. Educ. 54 ,754 (1977)
The classical "thermodynamics of a rubber band" (see Laswick,D.H., J.Chem. Ed. 49,469 (1972)) improved and explained. Simple apparatus.

*POLYMER APPARATUS COLLIG MEMBRANE OSMOSIS 4 5

Diffusion and Reverse Osmosis Through Polymer Membranes
Garbarini, G. R.; Eaton, R. F.; Kwei, T. K.; Tobolsky, A. V.
J. Chem. Educ. 48 ,226 (1971)
Research report. Special diffusion cells, conductance bridge. Evaluation of salt (NaCl) permeation of and/or diffusion through the reverse osmosis membranes Eastman RO-97 and RO-89 (cellulose acetate), and Nylon-6. Detailed introduction.

*POLYMER DEMO PREP 2

Preparation of a Polymer Latex
Guile, R. L.
J. Chem. Educ. 35 ,A24 (1958)
A Chem-Ed Tested Demo. Duponel-G + potassium persulfate + sodium metabisulfite. Monomer is styrene. (Duponel-G is a dispersing agent.)

*POLYMER CATALYSIS DEMO 2 3

Low-Temperature Polymerization: A Laboratory Demonstration
Jenkins, L. T.
J. Chem. Educ. 33 ,231 (1956)
Vinyl monomers in emulsion polymerization by titanous sulfate-persulfate; can be extended.

*POLYMER DEMO PREP 1

Rapid Preparation of 6-6 Nylon
Kinsinger, J. B.
J. Chem. Educ. 35 ,A60 (1958)
Adipyl chloride + hexamethylenediamine. A Chem-Ed Tested Demo. Caution: adipyl chloride is a lachrymator.

*POLYMER APPARATUS CATALYSIS IR ORGANOMETAL VACTEK VISC 4 HAZARD

Organometallic Catalyzed Synthesis and Characterization of Polyethylene: An Advanced Laboratory Experiment
Kranbuehl, D. E.; Harris, T. V.; Howe, A. K.; Thompson, D. W.
J. Chem. Educ. 52 ,261 (1975)
Ziegler-Natta polymerization on vacuum system using organotitanium chlorides and diethylaluminum chloride. Molecular weight by viscosity, branching by methyl groups determined by IR on thin films from hot pressing. Catalysts are commercially available.

*POLYMER ANAL ORG IR PREP 3

Polymer Preparation in the Laboratory
Lampman, G. M.; Ford, D. W.; Hale, W. R.; Pinkers, A.; Sewell, C. G.
J. Chem. Educ. 56 ,626 (1979)
Prep. method given for 1) polystyrene foam, 2) cross-linked maleic-phthalate-based polyester, 3) resiliant polyurethane foam, 4) melamine-formaldehyde laminate, 5) cellulose triacetate (etc.) films. Explicit procedures. Analysis of films by IR.

*POLYMER APPARATUS PREP 4

Physical Chemistry of Crosslinked Polysulfide Elastomers
MacKnight, W. J.; Leroi, G. E.; Tobolsky, A. V.
J. Chem. Educ. 42 ,4 (1965)
Preparation of a 10 percent crosslinked polyethylene tetrasulfide and stress relaxation measurements (these require stress relaxation balance - costly, could be made, but no directions).

*POLYMER PREP REVIEW 4 5

Review of Laboratory Methods for the Preparation of Polymer Films
Mano, E. B.; Durao, L. A.
J. Chem. Educ. 50 ,228 (1973)
Review with 115 references. Covers preparation on solid and liquid surfaces, other methods.

*POLYMER FREERAD KIN NOPROC PREP RADIOCHEM TRACER 4

Free Radical Polymerization of Styrene: A radiotracer experiment
Mazza, R. J.
J. Chem. Educ. 52 ,476 (1975)
Kinetics of styrene polymerization from specific activity of polymer and initiator (AZBN). C-14 labelled azobis isobutyronitrile prep'n. Liquid scintillation counter.

*POLYMER PHYS ACBA KIN PREP TITN 3 4

Kinetics of Condensation Polymerization: Preparation of a Polyester
McCaffery, E. L.
J. Chem. Educ. 46 ,59 (1969)
Dibasic acid or anhydride and glycol condensation; extent of reaction followed by amount of water formed and titration.
CAUTION: maleic anhydride (if used) is toxic.

*POLYMER ACBA DEMO PREP 2

The Nylon Rope Trick: Demonstration of Condensation Polymerization
Morgan, P. W.; Kwolek, S. L.
J. Chem. Educ. 36 ,182 (1959)
Interfacial polymerization of hexamethylenediamine and dibasic acid chloride. The first description of a classic demonstration and experiment.
See *POLYMER for subsequent notes and improvements.

*POLYMER PHYS GC KIN 4 HAZARD

Reactivity Ratios From Copolymerization Kinetics: A quantitative gas-liquid chromatography experiment
Mukatis, W. A.; Ohl, T.
J. Chem. Educ. 49 ,367 (1972)
Detailed discussion. Copolymerization of styrene with methyl methacrylate; disappearance of each monomer followed. HAZARD: solvents are carcinogens.

*POLYMER PHYS STRUCT VISC 4

Conformation of Macromolecules
Napper, D. H.
J. Chem. Educ. 46 ,305 (1969)
Viscosity vs. conc. of polystyrene in toluene, cyclohexane, gives data to calculate conformational parameters (all discussed).

*POLYMER DEMO PREP 2

Phenol Furfural Polymer
Ostrup, G.
J. Chem. Educ. 37 ,A44 (1960)
Aq. phenol + furfural initiated by HCl. A Chem-Ed Tested Demo.

*POLYMER PREP 3 HAZARD

Preparation of a Polysulfide Rubber
Pettit, G. R.; Pettit, G. R., III
J. Chem. Educ. 55 ,472 (1978)
Improved procedure for copolymerization of ethylene dichloride with sodium sulfide to yield the elastomer Thiokol A.
HAZARD: Sulfides can react with moisture to yield toxic H2S.

*POLYMER DEMO PHOTO 2 3

Lecture Demonstrations of Polymer Structure Using Polarized Light
Rodriguez, F.
J. Chem. Educ. 46 ,456 (1969)
A demonstration, but could be used as an experiment for one or a pair of students.

*POLYMER PHYS DEMO 3

A Demonstration of Polymer Crosslinking and Gel Formation Without Heating
Ross, J. H.
J. Chem. Educ. 54 ,110 (1977)
Conversion of a soluble linear polymer into a cross-linked polymer, an insoluble elastic gel. Linear polymer: GANTREZ AN (a comm. copolymer of maleic anhydride and methyl vinyl ether) cross-linked at the anhydride groups by the addition of the hydroxyl groups of triethanolamine.
Explicit directions. A tested demonstration.

*POLYMER ORG KIN VACTEK 5

Polymerization Kinetics: Dead-end Radical Polymerization
Senogles, E.; Woolf, L. A.
J. Chem. Educ. 44 ,157 (1967)
High vacuum system, thermostatted bath, sealed tubes required for polymerization of lauryl methacrylate. Polymer formed at different times determined by precipitation.

*POLYMER DISTRIB ENVIRON SEPARATION SOLUB 4

Separation of Waste Plastics. An experiment in solvent fractionation.
Seymour, R. B.; Stahl, G. A.
J. Chem. Educ. 53 ,653 (1976)
Method for the separation of polystyrene, polymethyl methacrylate, polyvinyl chloride, polyvinyl acetate and low density polyethylene with common solvents given.

*POLYMER PHYS OSMOSIS VISC 4

Polymer Molecular Weight Distribution: An undergraduate physical chemistry experiment
Smith, D. R.; Raymonda, J. W.
J. Chem. Educ. 49 ,577 (1972)
Polyvinyl alcohol used for viscometry and osmometry. Altered Ubbelohde viscometer (req. glassblowing) and Zim-Meyerson osmometer. Research projects suggested.

*POLYMER ORG PREP 2 3

Polymer Synthesis in the Undergraduate Organic Laboratory
Sorenson, W. R.
J. Chem. Educ. 42 ,8 (1965)
Includes polyformaldehyde, a polyurethane, Nylon, a polyphenylene ether, polystyrene, isoprene-styrene copolymer.Caution: lachrymators, etc.

*POLYMER ORG PREP 3 HAZARD

Preparation and Crosslinking of an Unsaturated Polyester
An Organic Chemistry Experiment
Stevens, M. P.
J. Chem. Educ. 44 ,160 (1967)
Polyester from phthalic anhydride, maleic anhydride (HAZARD) and 1,5-pentanediol is prepared, then crosslinked with styrene and catalyst.

*POLYMER DEMO PREP 1 2

The Bakelite Demonstration: A Safer Procedure
Wilson, A. S.; Peterson, V. R.
J. Chem. Educ. 55 ,652 (1978)
Recipe: Formalin + phenol + gl. acetic acid. Modification of classic "Tested Demonstration" (Alyea) procedure. Does not bump.

*POLYMER ORG DEMO PREP 4 HAZARD

Anionic Polymerization of Vinyl Monomers: A Demonstration
Zilkha, A.; Albeck, M.; Frankel, M.
J. Chem. Educ. 35 ,345 (1958)
Anionic polymerization to form polystyrene.
HAZARD: butyllithium, exothermicity.

*POLYMER ORG PREP 4 HAZARD

Polymerization of Ethylene at Atmospheric Pressure:
A Demonstration Using a "Ziegler" Type Catalyst
Zilkha, A.; Calderon, N.; Rabani, J.; Frankel, M.
J. Chem. Educ. 35 ,344 (1958)
Amyllithium (HAZARD) is prepared and used with titanium(IV) chloride to polymerize ethylene under nitrogen.

*RADIOCHEM DECAY IONX 3

Radiochemical Separation of Thallium from Thorium by Anion Exchange Resin: A Tl-208 reservoir
Abrao, A.
J. Chem. Educ. 41 ,600 (1964)
Thorium chloride bound on strong anion exchange resin. After equilibration, Bi-212 (ThC) is present, decaying (60.5 min half life) to Tl-208. The short half life (3.1 min) daughter can be periodically eluted and decay constant measured.

*RADIOCHEM ANAL CONSUMERPROD ISOTOPE NATPROD PHARM 4 HAZARD

Isotope Dilution Analysis: Cholesterol in Gallstones and Caffeine in Tea, Cola and Nodoz
Ault, A.; Kraig, R.
J. Chem. Educ. 46 ,767 (1969)
Carbon(14)-labelled cholesterol, caffeine. Liquid scintillation counters. HAZARD: chloroform and dioxane are suspected carcinogens.

*RADIOCHEM INORG COORD EXCHANGE KIN TRACER 3

Ligand Exchange Kinetics by the Radioactive Tracer Technique
Barton, D.; Winter, K.
J. Chem. Educ. 43 ,93 (1966)
Trans-dichlorobisethylenediaminecobalt(II)chloride is converted to the carbonato complex; then allowed to exchange with C-14 labelled CO3=. Rate of exchange followed by counting techniques. Explicit directions.

*RADIOCHEM PHYS UVIS XRAY 4

The Radiolysis of Air-Saturated Solutions of Iodine: An undergraduate experiment involving an isobestic point
Bibler, N. E.
J. Chem. Educ. 45 ,722 (1968)
Gamma-induced I2-CCl4 reaction. Co-60 source or x-ray generator. Recording vis. spectrophotometer. Permits measurement of G values for two simult. reactions. 1 lab period.

*RADIOCHEM DEMO ELECTROPHOR 4

Separation of Pb-210 from Bi-210 by Low Voltage Electrophoresis: A Radiochemical Separation Experiment
Borke, M. L.; Rangoonwala, N.
J. Chem. Educ. 48 ,699 (1971)
Radium DEF sol'n (low activity) on cellulose acetate strips, 350v, 10 min. Scan end-window counter, also visualize spots.

*RADIOCHEM ANAL APPARATUS NEUTRON 4 HAZARD

A Californium-252 Neutron Source For Student Use
Bowen, H. J.
J. Chem. Educ. 52 ,682 (1975)
Design of a nearly uniform source given. Approx. $100 of special equipment. 5 student neutron activation experiments described (V-52, Ag, Mn in ores, Na in glass, W in complexes). HAZARD: source must be stored and used surrounded by concrete. 1-hr max. exposure.

*RADIOCHEM DEMO SEPARATION 1

Separation of Ce-144 from Pr-144: A radiochemistry demonstration
Bradley, A.; Adamowicz, M.
J. Chem. Educ. 36 ,136 (1959)
Intended for high schools. Milligram quantities of cerium and praseodymium are separated by filtration of the insoluble iodate of cerium(IV). Explicit directions.

*RADIOCHEM SOLUB TRACER 4

Solubility of Neodymium Oxalate by Coprecipitation with Pm-147
Bradley, A.; Peterson, H. T., Jr.
J. Chem. Educ. 37 ,398 (1960)
Research report. Pm(147) used as a tracer for Nd. This can be done because the chemical properties of the two lanthanides are very similar.

*RADIOCHEM APPARATUS DEMO IONX 4

Measurement of the Half Life of UX2(Pa-234) with a Dipping Counter
Braunstein, J.; Young, R. H.
J. Chem. Educ. 38 ,31 (1961)
Th(234) is separated from uranyl nitrate solution by cation exchange; uranyl is eluted with H2SO4 sol'n; Pa(234) formed by decay of the Th(234) on the column is then eluted with HCl. Apparatus given schematically; directions for performing the exp't as a demo are very clear. The demo is suitable for Gen. Chem., but not the experiment itself.

*RADIOCHEM PREP 4

Preparation and Application of Carrier-Free Pb-212 in a Radiochemical Teaching Laboratory.
Broda, E.; Schonfeld, T.
J. Chem. Educ. 54 ,577 (1977)
Comment on Kvale and Skerestad, J. Chem. Ed. 51, 756 (1974); gives a simple cheap method for the preparation of the tracer. A Chem Ed. Compact.

*RADIOCHEM ORG PHYS EXCHANGE KIN TRACER 3

The Kinetics of an Exchange Reaction Using a Radiochemical Tracer
Brown, G. R.; Winkler, C. A.
J. Chem. Educ. 53 ,461 (1976)
I-131 half life of 8.15 days. Exchange is: NaI* + nC4H9I = NaI + nC4H9I*
Requires one 4-hr period. Student directions by writing. B-counter, centrifuge, thermostat.

*RADIOCHEM IONX 4

A Thorium-234 "Cow" for Pa-234
Carswell, D. J.; Lawrance, J. J.
J. Chem. Educ. 36 ,499 (1959)
Anion exchange - DeAcidite FF; cation exchanger in the overflow circuit. Details of construction of the apparatus given.

*RADIOCHEM DECAY 3

Demonstration of a Parent-Daughter Radioactive Equilibrium Using Cs-137-Ba-137m
Choppin, G. R.; Nealy, C. L.
J. Chem. Educ. 41 ,598 (1964)
Cs-137 which decays (half life 30 y.) to Ba-137m (half life 2.6 m.) is separated by pptn and filtration of BaSO4. Ba-137 counted in solid and in solution, allows measurment (well-type scintillation counter) of half life.

*RADIOCHEM COURSE INTEGR REVIEW 4

Nuclear Experiments in the Chemistry Curriculum
Clark, H. M.
J. Chem. Educ. 47 ,203 (1970)
Review with 88 references (all checked for inclusion in this file).

*RADIOCHEM DEMO REVIEW 2 4

Criteria For Experiments in Radiochemistry
Clark, H. M.
J. Chem. Educ. 40 ,618 (1963)
Design of experiments and incorporation into undergraduate curriculum described. Not an experiment.

*RADIOCHEM COLUMNC DECAY 4

A Praseodymium-144 Cow
Cockcroft, W. E.
J. Chem. Educ. 50 ,633 (1973)
Ce-144, Pr-144 system. Wet separation via MnO2 column. Details of construction and preparation given. G-M counter.

*RADIOCHEM ANAL COMPLEX EDTA IONX TRACER UVIS 4

Determination of Calcium in Sea Water: Analytical Experiment Using the Radionuclide Ca-45
Corless, J. T.
J. Chem. Educ. 42 ,421 (1965)
Elution of Ca from Dowex-50 followed by Ca-45 tracer. EDTA endpoint detected spectrophotometrically (Murexide).

*RADIOCHEM AUTORAD CONSUMERPROD 1

Radioactivity Experiments for High Schools Using Orange Glazed Ceramics
Crawley, H. W.
J. Chem. Educ. 36 ,202 (1959)
Uranium glazes in orange pottery have high levels of activity, measured by exposure of x-ray film and by Geiger counter, and compared with radioactive materials.

*RADIOCHEM ANAL NEUTRON 4

Determination of Copper in Alloys by Fast Neutron Activation
Daly, P. J.; Hofstetter, K. J.
J. Chem. Educ. 44 ,412 (1967)
Fast neutron source. GM counter, scaler. 1 lab period. Straightforward.

*RADIOCHEM INTEGR TECHNIQUE 4

Some Convenient Laboratory Experiments in Radiochemical Techniques
Dillard, C. R.; Morton, L.
J. Chem. Educ. 35 ,238 (1958)
Exp'ts which could be included as part of courses in P.Chem, Inorganic or Inst. Anal are outlined.

*RADIOCHEM PHYS DRYLAB 3

A Rutherford Elastic Scattering "Experiment"
Duggan, J. L.; Yegge, J. F.
J. Chem. Educ. 45 ,85 (1968)
Data from Oak Ridge using Cockcroft-Walton accelerator on deuteron scattering from carbon and from nickel can be used to calculate nuclear cross sections.

*RADIOCHEM ORG ISOMERS ISOTOPE 4

Nitration of Benzoic Acid: Determination of Isomer Distribution by the Isotope Dilution Technique
Feldman, M.; Wheeler, J. W.
J. Chem. Educ. 44 ,464 (1967)
C-14 benzoic acid nitrated; liq. scintillation counter. Detailed directions.

*RADIOCHEM DISTRIB TRACER 4 HAZARD

Distribution Coefficients and Ionization Constant of HAuCl4: A radioactive tracer method
Forsberg, H. G.; Widell, B.; Ervall, L-G.
J. Chem. Educ. 37 ,44 (1960)
Au-198 tracer used to measure distribution of AuCl3 between water and isopropyl ether. Hazard: Isopropyl ether forms explosive peroxides.

*RADIOCHEM APPARATUS ELECTROCHEM IONX 4

The Self-Absorption of the Beta-Radiation of Ni-63 In Metallic Nickel Sources: A Demonstration Experiment
Gelsema, W. J.; Donk, L.; VanEnckevort, J. H.; Blijleven, H. A.
J. Chem. Educ. 46 ,528 (1969)
Varying thicknesses of Ni-63 deposited electrolytically for end-window counting.

*RADIOCHEM PAPERC 4

A Simple Separation and Identification of Radium D, E, and F
Glasoe, P. K.
J. Chem. Educ. 48 ,268 (1971)
Solvent: heavy phase of HCl/n-butyl alcohol mixture. GM counter plus alpha counting if desired.

*RADIOCHEM DRG PHYS EXCHANGE KIN THERMO TRACER 4

The Methanolysis of Substituted Methyl Benzoates: An Exchange Reaction Illustrating Linear Free Energy Relationships
Glover, I. T.; Peterson, C. W.
J. Chem. Educ. 45 ,241 (1968)
C-14 methyl esters of subst. benzoic acids prepared from acyl chlorides and C-14 labelled methanol. Requires vac. distn. Rate of exchange with unlabelled CH3OH followed by measuring rate of disappearance of radioactivity from ester. Scintillation counting.

*RADIOCHEM AUTDRAD ENVIRON 0

Junior High School/University Cooperative Experiment: Collection and analysis of fresh nuclear debris
Griffin, J. J.; Driscoll, J. R.
J. Chem. Educ. 50 ,438 (1973)
JHS collected nuclear debris (wind-borne) from P.R. China blast of Mar. 18, 1972 using a modified vacuum cleaner. Samples were analyzed at Boston College radiochem lab. Autoradiography procedure given. We hope that opportunities for this experiment will be limited.

*RADIOCHEM APPARATUS AUTDRAD ENVIRON 1

A Passive Nuclear Debris Collector
Griffin, J. J.; Stevens, R. L.; Pszenny, A. A. P.; Russell, I. J.
J. Chem. Educ. 56 ,475 (1979)
The collector consists of a coffee can with both metal ends removed and its clear plastic top perforated with 80 4-mm holes. A piece of filter paper is cut out to fit in the lid; the can is placed under a drainspout. The filter paper is dried and used for autoradiography. A GM counter and gamma ray spectro. can be used to measure decay rates and energies, and thus identify components.

*RADIDCHEM DECAY NOPRDC 3

Nucleonics Experiment: The Half-Life of K-40 by Liquid Scintillation
Grunewald, R.
J. Chem. Educ. 46 ,369 (1969)
Short note describes an experiment developed for the nucleonics lab. Activity of a K-40 solution measured with a liq. scintillation counter. No details.

*RADIOCHEM DECAY DEMO EDTA IONX NOPROC 4

Growth and Decay of Radionuclides: A demonstration
Hayes, R. L.; Butler, W. R.
J. Chem. Educ. 37 ,590 (1960)
An experiment is described where Ba-137m is separated from Cs-137 by an ion-exchange technique in approx. 30 seconds. The ion-exchange apparatus is shown in a diagram. EDTA solutions are used as eluants.

*RADIOCHEM PREP 5 HAZARD

Concentrating Radioactivity
Hermann, R. A.
J. Chem. Educ. 51 ,420 (1974)
This is not a student experiment. How to get the radioactivity off a radium-dial alarm clock. HAZARD: no one but an experienced technician used to dealing with radioactive materials should perform this operation.

*RADIOCHEM ORG TRACER 3

A Facile Identification of Carbon-14 In Labelled Acetate
An Undergraduate Organic Experiment
Hill, T. B.
J. Chem. Educ. 54 ,252 (1977)
Designed for large classes. Acetic acid, labelled at C-1 or C-2 is given to students as an unknown. Student reacts HOAc* with anisole in the presence of polyphosphoric acid. Ketone product yields iodoform on hypoiodite degradation, which may be filtered and counted. License-exempt quantities. Safety considerations detailed.

*RADIOCHEM TECHNIQUE 4

Solid-State Track Detectors: A novel tool for the study of fission phenomena
Iyer, R. H.
J. Chem. Educ. 49 ,742 (1972)
Det'n of the U-235 content of natural uranium using the solid state track detector Lexan. Sample is irradiated with thermal neutrons. Only U-235 fissions, leaving tracks. Construction of target apparatus (simple).

*RADIOCHEM ANAL ISOTOPE 4

A Relative Isotope Dilution Analysis Using Samples of Infinite Thickness: For Undergraduate Instrumental Analysis
Johnston, C. B.; Drake, G. W.; Wentworth, W. E.
J. Chem. Educ. 46 ,284 (1969)
Ca-45 standards plus unknown. Drying oven, counter, special planchet, Clay-Adams pipettor.

*RADIOCHEM DECAY IONX 4

A Demonstration of Rapid Radioactive Decay
Jones, W. H.
J. Chem. Educ. 34 ,406 (1957)
Decay of a metastable form of Pb-207, half-life 0.8 seconds, followed by scintillation counting. The long-lived parent is radio-bismuth, prepared from ordinary lead by a (p,n) reaction in the 86-inch cyclotron at ORNL. Pb-207m separated from Bi-207 by ion-exchange.

*RADIOCHEM DEMO SURFACE TECHNIQUE 4

Separation of Cesium-137 and Barium-137m by Residue Adsorption
Kirby, H. W.
J. Chem. Educ. 48 ,269 (1971)
Residue adsorption is based on the principle that any inorganic compound that precipitates at the macroscopic level can be made to adsorb on a non-reactive surface at the trace-level. Differential solubilities of phosphates in NH3. GM or scintillation counter.

*RADIOCHEM ANAL GRAVIM TRACER 4

A Radiometric Method for Sulfate Analysis
Klehr, E. H.
J. Chem. Educ. 49 ,644 (1972)
Ba-133 tracer. Modification of classic BaSO4 pptn with ppt counted instead of weighed. Scintillation or GM counting.

*RADIOCHEM INORG PHYS CATALYSIS COLOR DEMO VACTEK 4

Chemical Reactions of Color Centers
Kohn, H. W.
J. Chem. Educ. 42 ,356 (1965)
Irradiated silica gel. Requires state-of-the-art vacuum and radiation technology, e.g. Van de Graaf generator. Suitable for project.

*RADIOCHEM CHROMATOG DECAY IONX 4

Radiochemical Study of the Separation of Lanthanum From Barium by Cation Exchanger
Kruger, P.; Coryell, C. D.
J. Chem. Educ. 32 ,280 (1955)
Genetic study of Ba-140/La-140 and a La-140 reservoir. Parent-daughter separation by ion exchange chromatog. and measurement of both beta and gamma activity. GM counter.

*RADIOCHEM COLUMNC DECAY NOPROC 4

Preparation and Application of Carrier-Free Pb-212 in a Radiochemical Teaching Laboratory
Kvale, E.; Skarestad, M.
J. Chem. Educ. 51 ,756 (1974)
From thorium-228 nitrate. Examples of laboratory exercises given, e.g., source preparation for detection and measurement of various radiations. Warning: follow safety regulations for handling of radioactive materials. For a simpler method, see Broda, E.: Schonfeld, T., this file (1977).

*RADIOCHEM ELECTROPHOR ISOTOPE 4

Birth of an Unique Parent-Daughter Relation: Secular Equilibrium, An experiment in radioisotope techniques
L'Annunziata, M. F.
J. Chem. Educ. 48 ,700 (1971)
Electrophoretic separation of 90-Sr/90-Y and subsequent observation of ingrowth of 90-Y. Spinco Model R cell. 1 lab period.

*RADIOCHEM DECAY 3

Nuclear Isomers Produced by Cobalt-60 Irradiation
Law, J. J.
J. Chem. Educ. 46 ,49 (1969)
Contact with Co-60 source activates thin foils of Sr, Cd, to metastable isomers. Gamma scintillation counting. Decay rate.

*RADIOCHEM ANAL BIOCHEM GRAVIM ISOTOPE TECHNIQUE 4

Isotopes in Chemistry Teaching
Libby, W. F.
J. Chem. Educ. 34 ,578 (1957)
Explicit directions for (1) analysis of a solution for sulfate, both radiochemically and gravimetrically, (2) studying crystal growth, (3) following pptn of basic carbonates, (4) following assimilation of C-14 by growing plants. These exp'ts are designed to teach students how to use a Geiger counter.

*RADIOCHEM DIPOLE KSP SOLUB TRACER 4

Solubility in Mixed Solvents: A radiochemistry experiment
Lochmuller, C.; Cefola, M.
J. Chem. Educ. 41 ,604 (1964)
Cobalt mercurithiocyanate solubility in alcohol-water measured using cobalt-60 tracer. Dielectric constant measured or from lit. Log Ksp vs. 1/D is linear, Bjerrum-Fuoss ion pair theory by ref.

*RADIOCHEM TECHNIQUE 4

Simple Liquid Scintillation Counting of C-14 Labelled *CO2
Loewenberg, J. R.; Grunewald, R.
J. Chem. Educ. 46 ,171 (1969)
Syringe removes CO2 gas sample, inserts it as slow bubbling through scintillation solution.

*RADIOCHEM ANAL PHYS KSP SOLUB TRACER 3

The Solubility of Zinc Oxalate: A physical chemistry experiment
Lyndrup, M. L.; Robinson, E. A.; Spencer, J. N.
J. Chem. Educ. 49 ,641 (1972)
Tracer experiment. Zn-65. License exempt quantities. Scintillation counter.

*RADIOCHEM ANAL ERROR ISOTOPE 4

Direct and Reverse Isotope Dilution Analysis: A Simple Experimental Approach Using Volumes.
Marshall, R. A. G.
J. Chem. Educ. 53 ,320 (1976)
P-32 as phosphate. Liquid G-M tube. Detailed error analysis. Method is for determination of liquid volumes.

*RADIOCHEM ANAL TRACER 4

Radiometric Analysis of Ammonia in Water
Mehra, M. C.
J. Chem. Educ. 49 ,837 (1972)
Ag-110 tracer follows release of Ag(+) from insol. silver salt (iodate, tungstate, selenite or phosphate) by dissolved ammonia. Solution scintillation counting.

*RADIOCHEM ANAL ORG GC TRACER 5 HAZARD

A Radiochemical Experiment in Gas Chromatography
Merrigan, J. A.; Nicholas, J. B.; Rack, E. P.
J. Chem. Educ. 43 ,543 (1966)
Completely dedicated chromatograph. Special counting cell. Tagged Br2 reacts in gas phase with CCl4 (HAZARD) or hexane to yield a variety of products. Chromatograms are plotted as counting rate vs. time.

*RADIOCHEM ANAL IONX TRACER 4

An Anion Exchange Radiochemical Experiment:
Separation of manganese, zinc, and iron
Morie, G. P.; Sweet, T. R.; Pitstick, G. F.
J. Chem. Educ. 41 ,389 (1964)
Tartrate complexes of Mn-54, Zn-65, Fe-59 tracers separated on anion exchange resin. Scint. counter.

*RADIOCHEM DEMO IONX TRACER 3

Ion Exchange on a Natural Clay Mineral: A demonstration experiment
Mucci, J. F.; Hollister, C.; Marshall, L. R.
J. Chem. Educ. 41 ,602 (1964)
Montmorillonite clay with successive Cs(+) + Cs-137(+), Co(+2), Co(+2) + Co-60(+2), and Cs(+) + Cs-137(+) shows relative binding Cs(+) more than Co(+2), retention volume.

*RADIOCHEM ANAL CHROMATOG IONX TRACER 4

Ion Exchange-Radiochemical Experiment
Mucci, J. F.; Spiegel, D. E.; Stearns, R. L.
J. Chem. Educ. 38 ,348 (1961)
Measure total exchange capacity of resin from elution curves. Dowex 50-X2. Chlorides. See later exp't., V.41, 163(1964).

*RADIOCHEM ANAL FLUOR IONX NOPROC XRAY 6

Energy Dispersive X-ray Fluorescence Analysis in Ion-Exchange Studies
Mucci, J. F.; Stearns, R. L.
J. Chem. Educ. 52 ,750 (1975)
X-rays from radioactive source (ref. to technique). Lithium-drifted silicon detector signal fed to channel analyzer. Cs^+ and Co^{++} on resin examined quantitatively.

*RADIOCHEM ANAL CHROMATOG IONX TRACER 4

The Cesium-Cobalt-Dowex 50-X2 System in H^+- Form
Mucci, J. F.; Stearns, R. L.; Fleishman, H. F.
J. Chem. Educ. 41 ,163 (1964)
Elucidation of ion-exchange chrom. process. Scintillation counter with pulse height analyzer. Fraction collector. Dowex-X2, chlorides.

*RADIOCHEM DECAY DISTRIB 4 HAZARD

Method to Determine the Half-Life of K-40
Navarrete, M.
J. Chem. Educ. 46 ,368 (1969)
Elegant experiment based on measurement of K-40 decay rate and detection efficiencies using Pa-234 from uranyl nitrate. HAZARD: $CHCl_3$ used in purification of uranyl nitrate by cupferron, is a carcinogen.

*RADIOCHEM SURFACE TRACER 4 5

Measurement of the Specific Surface Area of Lead Sulfate Using Sulfur-35
Nealy, C. L.; Choppin, G. R.
J. Chem. Educ. 41 ,597 (1964)
Sulfate labelled with S-35 (weak beta emitter) used to prepare $PbSO_4$ solid and determine ratio $PbSO_4$ on solid surface to $PbSO_4$ in solution.

*RADIOCHEM DIFFUSION EXCHANGE NOPROC TRACER 5

Radio Tracer Studies of Metal-Metal Ion Exchange
Newman, D. S.
J. Chem. Educ. 42 ,424 (1965)
Research report on tracer zinc, cadmium, silver ion in equilib. with metal surface to measure metal ion exchange and metal diffusion. Suitable for student project work. Requires some glass-blowing.

*RADIOCHEM COURSE TECHNIQUE 4

Radioisotope Experiments in the Orins Summer Institute Programs
Overman, R. T.; Coffet, D. L.; Muse, L. A.
J. Chem. Educ. 35 ,296 (1958)
No procedure, or minimal procedures. Outline of techniques taught at the Oak Ridge Institute of Nuclear Studies for science teachers.

*RADIOCHEM DECAY DISTRIB 4 HAZARD

Three Convenient Laboratory Experiments in Radiochemistry
Parekh, P. P.; Pant, D. R.
J. Chem. Educ. 47 ,71 (1970)
Sep'n of daughters of comm. thorium nitrate. GM and gamma scintillation counters. Caution: extractant is diallyldithiocarbamido-hydrazine (carcinogen?), (prep'n ref.). HAZARDS: $CHCl_3$, carcinogen; isopropyl ether forms explosive peroxides.

*RADIOCHEM BIOCHEM IONX UVIS 4

Iron Metabolism in the Rat: An experiment in biochemistry
Paul, K. G.; Stigbrand, T.
J. Chem. Educ. 47 ,722 (1970)
Rats injected with iron-59 citrate sacrificed. Hemin isolated from blood, ferritin from liver, myoglobin and cytochrome C from heart or skeletal muscle by extraction, centrifugation, ionx. Assay by uvis; ferritin with sulfosalicylic acid, and by radiochem.

*RADIOCHEM NEUTRON TRACER 2

A Freshman Experiment in Neutron Activation Analysis
Pickering, M.
J. Chem. Educ. 49 ,430 (1972)
Det'n of Mn in iron wire. Irradiations are not performed by students. Experiment is safe, but take intelligent precautions. Explicit procedure for sep'n of Mn(*) from Fe+3, using Mn+2 carrier, controlled pH pptn Fe(OH)3; addition of 6% H2O2 ppts MnO2. GM counting.

*RADIOCHEM DISTRIB 4 HAZARD

Alpha Spectroscopy Using Thorium Daughter Products
Pickering, M.; Davis, R.
J. Chem. Educ. 49 ,432 (1972)
Straightforward. Carrier-free preparation. Thorium extracted with tributyl phosphate/chloroform. HAZARD: chloroform is a carcinogen.

*RADIOCHEM DECAY IONX 4

Determination of The Half-Life of Thorium-234
Pinnell, R. P.
J. Chem. Educ. 47 ,459 (1970)
Th-234 obtained from comm. uranyl nitrate and separated from uranium by ion exch. chromatog. as chlorides. Uranium recovered as the ferrocyanide. Activity of Th-234 counted on column, GM.

*RADIOCHEM ANAL ISOTOPE TRACER 2

A Simple Isotope Dilution Analysis Experiment
Pope, C. G.
J. Chem. Educ. 52 ,343 (1975)
Linde mol. sieve 13x in solution with the zeolite pellets are analyzed for sodium using Na-22.

*RADIOCHEM ANAL NEUTRON 5

An Elegant Neutron Activation Analysis: An undergraduate experiment
Rengan, K.
J. Chem. Educ. 55 ,203 (1978)
Requires activation in a nuclear reactor, and vanadium standard. Vanadium, aluminum, and chromium in non-ferrous alloy. Uses state-of-the-art gamma ray spectroscopy. Li-drifted Ge detector, multichannel analyzer.

*RADIOCHEM KSP SOLUB TRACER 4

Radioisotope Demonstration of Common Ion Effect on Solubility
Rieckehoff, I. G.; Roig, E.; Russo, C. S.; Curet, J. D.
J. Chem. Educ. 38 ,350 (1961)
Effect of common ions on the solubility of TlCl (thallous chloride) followed by labelling Tl^+ solution with Tl-204. Explicit directions.

*RADIOCHEM IONX 4

A Simple Ba-137m - Cs-137 Milking System for Secular Equilibrium Studies
Ruddy, F. H.
J. Chem. Educ. 51 ,689 (1974)
Prep'n given for thallous phosphotungstate ion-exchanger plus Cs-137 - Ba-137m activity (adsorbed). Elution separates univalent Cs from divalent Ba. Count simultaneously crystal photomultipliers.

*RADIOCHEM ORG PHYS EXCHANGE ISOTOPE KIN 2

A Kinetics Experiment for First Year Chemistry
Schaefer, W. P.
J. Chem. Educ. 41 ,558 (1964)
I-131 exchange with various alkyl iodides in acetonitrile. Counted as liq. or filter paper, GM counter. Assumed 2nd order.

*RADIOCHEM ANAL EXPLOSION GRAVIM TECHNIQUE. TRACER 4 HAZARD

Radiochemical Investigation of Some Sample Destruction Procedures.
Servant, D. M.
J. Chem. Educ. 51 ,550 (1974)
Ag-110 used to evaluate ashing of AgX in strip film. Well-type scint. counter. One method is a HAZARD: hot $HClO_4/HNO_3$ + organic material is an explosion hazard.

*RADIOCHEM PHYS KSP TRACER 4

The Solubility of Thallium(I) Bromide: A radiochemistry experiment
Sheppard, J. C.; Jensen, R. C.
J. Chem. Educ. 40 ,34 (1963)
TlBr solubility determined using microcurie amnts of Tl-204. Const. temp. bath; end-window Geiger counter. Complete directions given and suggestions for further investigations. Caution: Thallium compounds toxic.

*RADIOCHEM PHYS DISTRIB TRACER 4

Extraction of Cobalt(II) Complexes: A radiochemistry experiment
Sheppard, J. C.; Jensen, R. C.
J. Chem. Educ. 40 ,33 (1963)
Distribution of Co(II) triauryl amine complexes between xylene and dil. HCl. Measured using Co-60 tracer. Well-type scintillation counter. Studies effect of conc. and pH.

*RADIOCHEM DECAY DISTRIB IONX NOPROC REDOX 4

Some Chemical Properties of Neptunium: A radiochemistry experiment
Sheppard, J. C.; Jensen, R. C.
J. Chem. Educ. 40 ,35 (1963)
Np-239 (by neutron activation of U-238) is not an alpha emitter. Separated fission products by ion exchange or solvent extraction. Redox chemistry, decay constant can be studied.

*RADIOCHEM DECAY 2

A Half-Life Experiment for General Chemistry Students
Smith, W. T.; Wood, J. H.
J. Chem. Educ. 36 ,492 (1959)
Measurement of the half-life of Bi-210.

*RADIOCHEM DECAY 4

Using The Decay of Ba-137 to Determine Resolving Time in G-M Counting
Stearns, R. L.; Mucci, J. F.
J. Chem. Educ. 38 ,29 (1961)
Counting rate as function of time is used. Sample by adsorption of Ba-137 on $BaCO_3$.

*RADIOCHEM DISTRIB EXCHANGE ISOTOPE KEQ 3 HAZARD

An Elementary Experiment Involving The Symmetry Number Concept
Tolpin, E. I.
J. Chem. Educ. 47 ,717 (1970)
Det'n of Keq for $(I\text{-}131)^- + I_2 \rightleftharpoons I^- + (I\text{-}131)\text{-}I$. Corrects the theory of Williams, R.R., et.al. J. Chem. Educ. 26, 214(1949). HAZARD: CCl_4 is carcinogen, use a substitute.

*RADIOCHEM ANAL AUTORAD OPTICAL PAPERC SEPARATION TRACER 2

Demonstration of Radioautography and Paper Chromatography Using a Polaroid Camera
Towne, J. C.; Gatti, B. M.
J. Chem. Educ. 40 ,243 (1963)
Separation of two C-14 labeled amino acids.

*RADIOCHEM DECAY NEUTRON PROJ 3

Neutron Activation Experiments in Radiochemistry
Vorres, K. S.
J. Chem. Educ. 37 ,391 (1960)
Extensive description of neutron activation with experimental results with different neutron sources. Provides material for projects or instructor designed experiments.

*RADIOCHEM ANAL BIOCHEM ISOTOPE TECHNIQUE 4

Substoichiometry and Saturation Analysis
Willett, J. E.; Servant, D. M.
J. Chem. Educ. 54 ,452 (1977)
Isotope dilution analysis modified by using equal substiochiometric amounts of precipitant. Determination of silver in photographic film and of human placental lactogen in serum. Scintillation counter.

*RADIOCHEM ORG FRIEDEL.CRAFTS NOPROC PREP PROJ TRACER 3 HAZARD

An Undergraduate Organic Experiment With Carbon-14
Wright, J. C.
J. Chem. Educ. 40 ,206 (1963)
Student is issued a small quant. labelled NaOAc in HOAc at equilibrium. To determine if label is C-1 or C-2, the acid is converted to an acyl chloride and used in Friedel-Crafts acylation of benzene to produce acetophenone, then converted to CHI_3 and counted. Acetophenone also oxidized to benzoic acid and counted. This was a seminal publication, but see newer exp'ts to avoid benzene. HAZARD: benzene, carcinogen.

PROJECT CHEMLAB

Corrections to Revised Lists, 1957-1979

S.C. Bunce, Dir.
J.W. Zubrick
C.B. Allen (State University of New York, Stony Brook)

June, 1983

Department of Chemistry
Rensselaer Polytechnic Institute
Troy, NY 12180

*ANAL

Baine, O.
J. Chem. Educ. 36 ,88 (1959)
Page 88 should read as page 388.

*ANAL

Bidleman, T. F.
J. Chem. Educ. 53 ,173 (1976)
TCL should read as TLC.

*PHYS

Brice, L. K.
J. Chem. Educ. 50 ,430 (1979)
Year 1979 should read as year 1973.

*PHYS

Cosaro, G.
J. Chem. Educ. 53 ,589 (1976)
G. Cosaro should read as G. Corsaro.

*PHYS

Davenport, D. A.
J. Chem. Educ. 39 ,252 (1961)
Year 1961 should read as year 1962.

*PHYS

Dehaan, F. P.
J. Chem. Educ. 51 ,263 (1974)
F.P. Dehaan should read as F.P. DeHaan.

*BIOCHEM

DeVine, J. E.
J. Chem. Educ. 52 ,816 (1975)
Phospholipase should read as Phospholipase A.

*PHYS

Dorfman, M. K.
J. Chem. Educ. 39 ,20 (1962)
This entry is a duplicate of one under the first credited author R.J. Kokes.

*PHYS

Emara, M. M.
J. Chem. Educ. 56 ,620 (1979)
Ion Association should read as Ionic Association.

*PHYS

Field, R. J.
J. Chem. Educ. 56 ,754 (1979)
Zaikin- should read as Zaikin-.

*ORG

Gilow, H.
J. Chem. Educ. 54 ,450 (1977)
Subtituent should read as substituent.

*PHYS

Gorodotsky, Malka
J. Chem. Educ. 55 ,66 (1978)
Malka Gorodotsky should read as M. Gorodotsky.

*INORG

Hagen, A. P.
J. Chem. Educ. 56 ,479 (1979)
Metal should read as transition metal.

*INORG

Haight, G. P., Jr.
J. Chem. Educ. 40 ,468 (1963)
Volume 40 (1963) should read volume 42 (1965).

*ANAL

Hurlbut, J. A.
J. Chem. Educ. 71 ,734 (1974)
Volume 71 should read as volume 51.

*INORG

Johnson, R. O.
J. Chem. Educ. 47 ,702 (1970)
R.O. Johnson should read as R.C. Johnson.

*INORG

Krahe, E.
J. Chem. Educ. 43 ,63 (1966)
Sequi- should read as Sesqui-.

*ANAL

Kump, K. I.
J. Chem. Educ. 55 ,265 (1978)
Na(EDTA) should be read as Na4EDTA.

*ANAL

Larsen, E.
J. Chem. Educ. 52 ,122 (1973)
Year 1973 should read as year 1975.

*INORG

Letkeman, P.
J. Chem. Educ. 56 ,348 (1979)
Methyldiethylenetriamine... should read as Metal Diethylenetriamine...

*PHYS

MacCallur, J. R.
J. Chem. Educ. 48 ,705 (1971)
J.R. MacCallur should read as J.R. MacCallum.

*PHYS

Mudrock, H. D.
J. Chem. Educ. 50 ,528 (1973)
H.D. Mudrock should read as H.D. Murdock.

*INORG

Neidig, H. A.
J. Chem. Educ. 42 ,475 (1965)
Entry was duplicated. This one may be deleted. Under *PHYS for the other, add keyword HAZARD and the HAZARD statement from this entry.
Level 4 should read as level 3.

*BIOCHEM

Pederson, D. M.
J. Chem. Educ. 71 ,268 (1974)
Volume 71 should read as volume 51.

*ORG

Pine, S. H.
J. Chem. Educ. 45 ,118 (1968)
-Clarke should read as -Clark.

*RADIOCHEM

Rieckehoff, I. G.
J. Chem. Educ. 38 ,350 (1961)
The first credited author should be E. Roig, not I.G. Rieckehoff.

*INORG

Shombert, D. J.
J. Chem. Educ. 47 ,781 (1970)
Page 781 should read as page A784.

*ORG

Shultz, A. G.
J. Chem. Educ. 56 ,555 (1979)
A.G. Shultz should read as A.G. Schultz.

*PHYS

Thomas, B.
J. Chem. Educ. 39 ,531 (1962)
B. Thomas should read as W.B. Thomas.

*INORG

Tietze, H. R.
J. Chem. Educ. 48 ,344 (1963)
Volume 48 should read as volume 40.

*INORG

Wehy, J. A.
J. Chem. Educ. 47 ,715 (1970)
J.A. Wehy should read as J.A. Weyh.

*INORG

Wilson, L. P.
J. Chem. Educ. 46 ,447 (1969)
L.P. Wilson should read as L.R. Wilson.

*PHYS

Wilson, S. A.
J. Chem. Educ. 54 ,513 (1973)
Year 1973 should read as year 1977.

*INORG

Worrall, I. J.
J. Chem. Educ. 49 ,510 (1969)
Volume 49 should read as volume 46.

*INORG

Woulf, A. H.
J. Chem. Educ. 55 ,738 (1978)
A.H. Woulf should read as A.A. Woolf. Keyword INTEGR should replace keyword QUAL. There is a duplicate entry under A.A. Woolf which may be deleted.

PROJECT CHEMLAB

Additions to Revised Lists, 1957-1979

S.C. Bunce, Dir.
J.W. Zubrick
C.B. Allen (State University of New York, Stony Brook)

June, 1983

Department of Chemistry
Rensselaer Polytechnic Institute
Troy, NY 12180

*ANAL GRAVIM NOPROC QUANT TITN 2

An Introductory Quantitative Laboratory Exercise
Crossfield, A. J.
J. Chem. Educ. 54 ,190 (1977)
Short note describes successful classroom use of analysis of (barium chloride dihydrate/ NaCl) mixtures for water (loss on heating) and total chloride (Mohr method) as introductory experiment.

*ANAL INORG GRAVIM STOICH 1 2

The Stoichiometry of Sulfides: Experiments for the introductory laboratory
Dingledy, D.; Barnard, W. M.
J. Chem. Educ. 44 ,693 (1967)
Direct combination of lead and nickel with sulfur used to demonstrate law of constant proportions. Unreacted sulfur is simply boiled off.

*ANAL DEMO TLC 2

TLC Separation of Ink Pigments
Druding, L. F.
J. Chem. Educ. 40 ,536 (1963)
Simple experiment to demonstrate TLC when it was a new technique. On layer of silica gel on glass plate, moving phase ethanol.

*ANAL GC IR NMR 3 HAZARD

Instrumental Techniques Demonstrated by Analysis of a Reaction Mixture
Fairless, B. J.; Dunn, H. E.; Foster, D. O.
J. Chem. Educ. 48 ,827 (1971)
A reaction mixture of alkyl aryl amines is analyzed by gc (analytical and preparative) and separated products by ir, nmr. HAZARD: arylamines are suspected carcinogens.

*ANAL FLUOR UVIS 3 HAZARD

Fluorescence Determination of Aspirin in APC Tablets
Fiigen, R. A.; Plude, J. L.; Seitz, W. R.
J. Chem. Educ. 56 ,658 (1979)
As part of determination of aspirin, phenacetin, caffeine in tablets. this is a modification to determine aspirin by fluorescence analysis. HAZARD: chloroform, used in extraction, is carcinogenic; substitute.

*ANAL DISTRIB 3

A Laboratory Experiment with Dyes to Illustrate Countercurrent Distribution
Arreguin, B.; Padilla, J.; Herran, J.
J. Chem. Educ. 39 ,539 (1962)
Craig countercurrent distribution illustrated with two solvents (1-butanol, aq. sodium carbonate), two dyes (phenol red, bromcresol green), and a set of either 6 or 29 separatory funnels.

*ANAL COMPUTER DRYLAB NOPROC 4

X-Ray Fluorescence Simulation
Breneman, G. L.
J. Chem. Educ. 56 ,303 (1979)
Program in BASIC permits analysis of variables, unknowns (simulated).

*ANAL ACBA ELECTROCHEM NOPROC 2

Conductance Experiments Utilizing a Wide-Range DC Meter
Carlton, T. S.
J. Chem. Educ. 44 ,769 (1967)
Directions for construction of inexpensive meter, and suggestions for use in measuring ionic conductance and acid strength.

*ANAL ORG PHARM TLC 3

TLC Separation of Drug Alkaloids
Chasar, D. W.; Toth, G. B.
J. Chem. Educ. 51 ,22 (1974)
Caffeine, quinine, brucine separated on silica gel plates; visualization by various methods, moving phase: methanol. CAUTION: the slurry used in preparing the plates uses a chloroform (carcinogen; toxic)/methanol mixture.

*ANAL APP DEMO GC 3 HAZARD

A Gas Chromatography Demonstration Apparatus
Cowan, P. J.; Sugihara, J. M.
J. Chem. Educ. 36 ,246 (1959)
Relatively simple apparatus for separating various organics. Hydrogen flow (pressure checked by oil manometer) thru column packed with Tide detergent powder or dinonyl phthalate on firebrick. Sample (10-20 microliters) thru serum cap, elution time by change in hydrogen flame characteristics. HAZARD: hydrogen forms explosive mixtures with air. Otherwise suitable for project, but some vaporized compounds are hazardous.

*ANAL QUAL QUANT 3

Combining Preparative and Quantitative Procedures in Qualitative Analysis
Fowles, G. W. A.
J. Chem. Educ. 39 ,401 (1962)
Experiments designed to combine preparative, qualitative analysis, and illustration of properties as alternative to qual. scheme. Here qualitative exp'ts on vanadium, copper, gold, determination of valency states of vanadium, preparative for tris-(thiourea)copper(I) chloride, quant. for copper.

*ANAL CRAVIM 1 2 HAZARD

The Determination of Copper in a Copper-Nickel Alloy: A New Experiment for the General Chemistry Laboratory
Gallagher, K.; Cantor, C. R.
J. Chem. Educ. 55 ,660 (1978)
Coinage alloy dissolved in nitric acid, then heated in conc. sulfuric. HAZARD: toxic vapors (nitrogen oxides, sulfur trioxide), but no mention. Copper pptd. as copper(I) thiocyanate, weighed. Designed for large classes.

*ANAL GC IR NOPROC SEQ UVIS 3

Xylene Analysis: Integrated experiment in instrumental analysis
Hanrahan, E. S.
J. Chem. Educ. 43 ,321 (1966)
A sequential, rather than integrated lab. Students use the first two methods to analyze impure alkyl benzenes (GC), with literature references only. UVIS is a supplement.

*ANAL APP ELECTROANAL 3

A Chemical Polarograph
Harris, W. E.
J. Chem. Educ. 35 ,408 (1958)
Simple polarograph (construction details) used for thallium analysis. CAUTION: thallium toxicity.

*ANAL INORG CONSUMERPROD TITN 2 3

Lighter Flint Chemistry
Hentz, F. C., Jr.; Long, G. G.
J. Chem. Educ. 53 ,651 (1976)
Iron, cerium, apparent equivalent weight determined (by hydrogen evaluation).

*ANAL QUAL QUANT UVIS 2

Qualitative and Colorimetric Analysis of Salicylic Acid
Hoops, S. C.
J. Chem. Educ. 51 ,782 (1974)
Simple color tests establish the basis for the quantitative determination of salicylic acid in urine by quantitative colorimetry. Designed for non-majors.

*ANAL CALORIMETRY TECHNIQUE 3 4

Study of the Periodate Oxidation of alpha-Diols by Direct Injection Enthalpimetry
Jeffries, D.; Fresco, J.
J. Chem. Educ. 51 ,545 (1974)
New technique for quantitative analysis, millimolar and micromolar range. Measure temperature rise by thermistor, bridge.

*ANAL EDTA PROJ 2 3

Investigation of Some Metallochromic Indicators
Jones, A. V., Nelson, M.
J. Chem. Educ. 56 ,755 (1979)
Introductory EDTA experiments include total hardness and calcium alone, in tap water. Effect of variation of pH, metal ion, etc., also studied. Extensions.

*ANAL GRAVIM IR QUANT 3

Use of Infrared Spectrophotometry in the Analysis of Limestone
Kalbus, G. E.; Kalbus, L. H.
J. Chem. Educ. 43 ,314 (1966)
Conventional anal. techniques supplemented by ir (KBr pellet) to determine what is taking place in the various anal. steps.

*ANAL GC QUANT 3

Qualitative and Quantitative Gas Chromatography for the Undergraduate
Karasek, F. W.; DeDecker, E. H.; Tiernay, J. M.
J. Chem. Educ. 51 ,816 (1974)
Piezoelectric crystal detector permits room temperature operation of detector. Experiments given for quantitative analysis of aliphatic (C-6 to C-10) and aromatic hydrocarbon mixtures by peak height and width.

*ANAL COLUMNC GELC 3

A Simple Apparatus for Teaching the Principles of Chromatography
Kellomaki, A.
J. Chem. Educ. 49 ,139 (1972)
In these experiments Sephadex G-10 functions largely by GDC to separate by tap water elution Blue Dextran and then various salts (by size of anion). Elution volumes of salts by conductivity cell.

*ANAL APP ENVIRON 1 2

Student Flowmeters and an Air Pollution Experiment
Kohn, H. W.
J. Chem. Educ. 49 ,643 (1972)
Glass wool absorbs hydrocarbon pollutants; amount shown roughly by heating to char afterward. Two new student flowmeters are described, for approximate flow measurements.

*ANAL EDTA KSP NOPROC SOLUB 3

The Solubility of CaSO4: An Ion Exchange-Complexometric Titration Experiment for the Freshman Laboratory
Koubek, E.
J. Chem. Educ. 53 ,254 (1976)
Calcium ion conc. of sat'd calcium sulfate solutions determined by (a) ion exchange followed by titration of sulfuric acid produced and (b) EDTA titration. Experiment is designed to show effect of ion pair formation and solubilities. One 2-3 hr lab period. Procedures by reference.

*ANAL BIOCHEM COLUMNC 3

A Simple Laboratory Experiment on PVP Column Chromatography
Lerner, J.
J. Chem. Educ. 47 ,32 (1970)
Microseparation of vitamin B-12, riboflavin, and horse cytochrome c on a polyvinylpyrrolidone column. Total effluent is 5 ml.

*ANAL ELECTROCHEM TITN 3

Analysis of Hypochlorite in Commercial Liquid Bleaches by Coulometric Titration
Lieu, V. T.; Kalbus, G. E.
J. Chem. Educ. 52 ,335 (1975)
Iodide-thiosulfate reaction. Also can be done potentiometrically.

*ANAL ORG DEMO REV TLC 2 3

TLC - Versatile Tool
Malins, D. C.; Wekell, J. C.
J. Chem. Educ. 40 ,531 (1963)
Experiments at several levels, involving separations of triglycerides. Studies of alcoholysis of triglycerides. An early "technique" set of experiments.

*ANAL COMPUTER DRYLAB 4

A Data Acquistion Experiment for Instrumental Analysis
Markman, R. R.; Bean, P. L.; Heinrich, G. L.; Freeland, S. J.; Jakob, F
J. Chem. Educ. 50 ,295 (1973)
An output simulating a first order rate study with widely varying rate constant was used, students wrote program for acquiring and processing (A to D) data.

*ANAL ENVIRON NOPROC PROJ 3 4

Analysis of "Industrial Waste": A quantitative laboratory project
Marshall, D. R.; Owen, N. L.; Underhill, A. E.
J. Chem. Educ. 54 ,584 (1977)
A synthetic "industrial waste" (water containing solvents, organics, and inorganic contaminants) is given to a student team for analysis by any method of their choice. 40 hours, and students must cooperate to finish. Qualitative and quantitative methods.

*ANAL CONSUMERPROO ENVIRON GC 2 3

Gas Chromatographic Analysis of Aerosol Propellants
Miller, J. M.
J. Chem. Educ. 54 ,735 (1977)
Most contain several components. Simple gc can detect different fluorocarbons, hydrocarbons, nitrous oxide.

*ANAL GC QUANT STATISTICS 4

Quantitative Gas Chromatography: An experiment
Pardue, H. L.; Burke, M. F.; Barnes, J. R.
J. Chem. Educ 44 ,695 (1967)
Hydrocarbon separation; analysis by integration. Basics of circuits for automation included; modern instrumentation has this.

*ANAL ATOMICABSORP CONSUMERPROD NOPROC 3

An Atomic Absorption Experiment in Food Chemistry
Paschal, D. C.
J. Chem. Educ. 53 ,165 (1976)
Manganese and zinc in cat food analyzed.

*ANAL TECHNIQUE UVIS 3

A Unique Approach to Teaching Spectrophotometric Procedures
Reeves, R. R.; Hutson, M. D.; Williams, H. P.
J. Chem. Educ. 52 ,659 (1975)
Directed only toward learning techniques. Mixtures of food colors and clothing dyes make artificial unknowns for choosing conditions for analysis. Like most "technique" experiments, it is not very stimulating.

*ANAL PAPERC QUAL 3 HAZARD

A Paper Chromatographic Scheme for the Identification of Metal Ions
Ritchie, A. S.
J. Chem. Educ. 38 ,400 (1961)
Elaborate scheme using four developing solvents to give Rf "profiles" characteristic of ions. HAZARD: two of the solvents include small amounts of conc. HF (can cause serious skin damage). Ions also detected by reagents.

*ANAL TECHNIQUE UVIS 3

Simplex Optimization of Chemical Systems
Shavers, C. L.; Parsons, M. L.; Deming, S. N.
J. Chem. Educ. 56 ,307 (1979)
Systematic variation of amounts of reagents in developing a color test, together with the simplex (theory explained) treatment to optimize the reaction conditions.

*ANAL AA 3 HAZARD

Determination of Blood Levels in the Analytical Laboratory
Stemporzewski, S. E.; Butler, R. A.; Barry, E. F.
J. Chem. Educ. 53 ,516 (1976)
Lead in blood by atomic absorption. HAZARD: how to get blood from humans without medical assistance?

*ANAL APP ELECTROCHEM NOPROC 3

Transistorized Power Sources for Constant Current Coulometric Titration
Stock, J. T.
J. Chem. Educ. 46 ,858 (1969)
Circuit diagrams. Suggestions for many experiments.

*ANAL ACBA KEQ TITN 3

Is a Weak Acid Monoprotic?: A new look at titration curves
Sturrock, P. E.
J. Chem. Educ. 45 ,258 (1968)
Weak acid titration, with criterion delta pH (change from 1/4 to 3/4 equivalence) greater than 1.0 for dibasic acid.

*ANAL NOPROC QUAL 2

Abridged Qualitative Analysis with Limited Reagents
Thompson, M. L.; Bixler, J. W.
J. Chem. Educ. 48 ,113 (1971)
Four cations (from a limited list) are identified using only HCl, H_2SO_4, NaOH, NH_3 by procedures which students must develop using refs.

*ANAL INORG COORD UVIS 2

An Experiment in the Characterization of Coordination Compounds
Williams, T. R.; Haynes, L. W.
J. Chem. Educ. 54 ,246 (1977)
An unknown cobalt coordination compound is given; various methods for identification are used, including UV-VIS spectrum.

*BIOCHEM ORG CAT ENZYME NATPROD PREP RESOLUTION 3

Ficin as a Catalyst in Organic Syntheses
Abernethy, J. L.; Leonardo, G. L.
J. Chem. Educ. 41 ,53 (1964)
Ficin, an enzyme derived from fig trees, and commercially available, catalyzes amide synthesis. Experiments include reaction of acylated amino acids (hippuric acid or carbobenzoxyalanine) with aminophenols. Synthesis of optically active amides in good yield if DL amino acids are used. Extensions suggested.

*BIOCHEM ENZY KIN UVIS 3

Acid Phosphatase Characterization: An undergraduate biochemistry laboratory experiment
Adams, G. S.; Towers, C. V.
J. Chem. Educ. 54 ,780 (1977)
Enzyme isolation as crude homogenate from beef liver, heart, or aorta. Assay by spectrophotometer (p-nitrophenol standard) at 410 nm. Extensions to investigate substrate specificity, inhibition, effect of metal ions, SH groups.

*BIOCHEM DEMO 1

Molecular Iodine from Gorgonians: A laboratory experiment in marine biochemistry
Ciereszko, L. S.; Chang, C. W. J.
J. Chem. Educ. 55 ,744 (1978)
A simple demonstration, not an experiment despite the title. Exoskeletons heated with conc. sulfuric acid give violet vapors.

*BIOCHEM ENZYME PAPERC 2 3

Allied Health Chemistry Laboratory: Amino acids, insulin, proteins, and skin
Dever, D. F.
J. Chem. Educ. 52 ,338 (1975)
Much detail on pre-lab, model building, student involvement. Complete experiment given. Paper chromatography of amino acids from skin extract, insulin, etc., developed with acetonitrile/ammonium acetate mixture. Visualization by ninhydrin.

*BIOCHEM APP MEMBRANE 4

A Simple Set-Up for Black Lipid Membrane Experiments
Huemoeller, W. A.; Tien, H. T.
J. Chem. Educ. 47 ,469 (1970)
Formation of membranes described; measured resistance, capacitance. Requires electrometer with multi-speed recorder.

*BIOCHEM IONX TLC 3

Ion Exchange and Thin Layer Chromatography Separation of Amino Acids
Hurlbut, J. A., Balka, T. J.
J. Chem. Educ. 55 ,794 (1978)
Aspartic acid/ arginine separated on cation exchange column followed by TLC for identification. A Chem-Ed compact.

*BIOCHEM CHIRAL ENZYME KIN NMR 4

The Fumarase Reaction: A nuclear resonance experiment for biological chemistry students
Kasperek, G. J.; Pratt, R. F.
J. Chem. Educ. 54 ,515 (1977)
Fumarase catalyzes malate to fumarate equilibrium. In deuterium oxide, measure rate and (by integration) equilibrium constant, measured by nmr spectral changes. Also measure rate of the replacement of a prochiral H by D.

*BIOCHEM 4

Hemoglobin: A Series of Biochemistry Experiments
Slabaugh, M. R.; Carrasco, C. R.
J. Chem. Educ. 52 ,67 (1975)
A listing only; details from authors.

*INORG DEMO ELECTROCHEM MOLTENSALT PROJ 1 3 HAZARD

Sodium Through Glass: A Lecture Demonstration Experiment Involving Electrons, Ions, and Atoms
Alpern, D. K.
J. Chem. Educ. 34 ,289 (1957)
Sodium ions travelling through glass wall of an incandescent light bulb are reduced to the metal by electrons from the filament. Unusual electrolysis experiment uses molten sodium nitrate as the electrolyte; electrical circuit through wire connected to bulb. HAZARDS: electrical shock; nitrate melts must be protected from contact with carbon-containing compounds, other reducibles. Setup shown is not protected from spills, breakage. Explosive.

*INORG PHYS DENSITY 2 HAZARD

The Density of a Single Crystal of Ammonium Oxalate Monohydrate by the Flotation Method
Bergendahl, T. J.
J. Chem. Educ. 56 ,617 (1979)
Mixed solvent method uses acetone - carbon tetrachloride (HAZARD: should be possible to substitute).

*INORG PHYS ACBA DEMO ELECTROCHEM 2

A Comparison of Base Strengths Using Visual and EMF Observations
Campbell, J. A.
J. Chem. Educ. 52 ,185 (1975)
Copper(II) solutions give precipitates with various anions. Base strengths estimated by competitive reactions, then measured with copper electrode and zinc reference electrode. For instructors only. CAUTION: avoid cyanides.

*INORG ANAL MAGNETIC NOPROC PREP PROJ SOLID XRAY 4

Normal and Inverse Ferrite Spinels: A set of solid state chemistry related experiments
Chaumont, C.; Burgard, M.
J. Chem. Educ. 56 ,693 (1979)
Preparations require muffle furnace. Magnetic properties. Extensions.

*INORG COORD UVIS 3

Allowed and Forbidden d-d Transitions in Tris-oxalato-Cr(III) Anion
Eaton, S. S.; Yager, T. D.; Eaton, G. R.
J. Chem. Educ. 56 ,635 (1979)
Preparation of the potassium salt by reference. Visible spectroscopy in aq. sol'n gives wavelength of allowed and forbidden bands, permitting calculation of ligand field strength.

*INORG GAS PREP 2 HAZARD

A Temperature-Sensitive Stirring Rod: Liquefaction of NO2 as a student experiment
Eddy, R. D.; Scholes, S. R., Jr.
J. Chem. Educ. 35 ,527 (1958)
A small amount of nitrogen dioxide and its equilibrium dimer prepared and sealed in a small glass tube. A charming experiment, but (HAZARD) nitrogen oxides are toxic.

*INORG DRYLAB ISOTOPE NOPROC 2

Isotopy, A General Chemistry Experiment
Ehlert, T. C.
J. Chem. Educ. 48 ,273 (1971)
Recorded mass spectra of elements used to identify elements.

*INORG COMPLEX PREP SEQ 3 4

An Experiment Involving the Chemistry of Systems Containing Metal-Metal Double, Triple and Quadruple Bonds
Glicksman, H. D.; Walton, R. A.
J. Chem. Educ. 54 ,712 (1977)
Six rhenium complexes in sequence, beginning with perrhenate. Some by literature ref. Extensions suggested.

*INORG ANAL STOICH 1

Determining an Empirical Formula: A simple, rapid high school experiment
Harris, S. P.
J. Chem. Educ. 37 ,516 (1960)
Copper wire heated in sulfur vapor and weight changes measured on simply constructed balance. CAUTION: Adequate ventilation required.

*INORG COORD POLARIM PREP RESOLUTION 2 3

Synthesis and Properties of an Optically Active Complex: A polarimeter experiment for general chemistry
Hunt, H. R., Jr.
J. Chem. Educ. 54 ,710 (1977)
Cobalt(II)-phenanthroline complex resolved by pptn. as antimony d-tartrate salt, then oxidized by chlorine (from HCl + KMnO4) to cobalt(III) complex. Extensions.

*INORG PROJ 1 2

The Growth of Lead Trees in Silicic Acid Gels
Hurd, C. B.; Lamareaux, H. F.
J. Chem. Educ. 36 ,472 (1959)
Lead nitrate, dilute acetic acid and sodium silicate gel in test tube. Zinc metal to form tree. Extensions, refs. to earlier J. CHEM. EDUC. (1929-1935).

*INORG CORROSION DEMO ELECTROCHEM 2

Cathodic Protection Using a Photovoltaic Source
Lauren, P. M.
J. Chem. Educ. 55 ,319 (1978)
Suitable as project. Iron electrodes, photovoltaic cell, ferroxyl gel indicator shows anode and cathode by pH change. Also can show protection with sacrificial electrode.

*INORG NOPROC 2

Writing Chemical Equations: An introductory experiment
LeMay, H. E., Jr.; Kemp, K. C.
J. Chem. Educ. 52 ,121 (1975)
Students identify simple unknowns from their reactions and a simple table of names and properties. An "early" experiment.

*INORG APPARATUS ELECTROCHEM 3

An Illustration of the Absorption of Hydrogen by Metals
Lewis, F. A.
J. Chem. Educ. 34 ,601 (1957)
Palladium and platinum electrodes of 48 volts DC show increase in diameter of Pd because hydrogen formed electrolytically is absorbed. Measure pressure of H2 evolved on heating.

*INORG DRYLAB 1

Mendeleev's Periodic Law: A laboratory exercise
Logan, K. R.
J. Chem. Educ. 53 ,647 (1976)
Students given (known and unknown) samples of elements. Task is to decide placement in periodic table by (given) properties.

*INORG PROJ REDOX STOICH 1

A Simple Oxidation-Reduction Experiment
Ludeman, S. M.; Brandt, J. A.; Zon, G.
J. Chem. Educ. 53 ,377 (1976)
Copper (as sulfate, aq.), and lead (as acetate, aq.) self deposit on weighed zinc strips; rate of deposition is studied as a class project. Would make a good "early" experiment to teach analytical balance. Rather sketchy.

*INORG NOPROC PAPERC PROJ THERMO UVIS 3 4

The Polyhalide Experiment and the Open University Summer School
Mason, J.
J. Chem. Educ. 52 ,244 (1975)
A polyhalide such as KICl2 is given as unknown. Preliminary experiments with halogens, halides, interhalogens. Open ended.

*INORG QUAL 1 2

A General Chemistry Experiment on the Identification of Reaction Products
Preer, J. R.
J. Chem. Educ. 52 ,389 (1975)
Inorganic reactions are investigated as unknowns, using observation and a handbook.

*INORG ACBA CONSUMERPROD 2

Research Project for General Chemistry Laboratory
Schwolow, J.
J. Chem. Educ. 35 ,416 (1958)
"In vitro" treatment of "acid stomach" with antacids. Buffer capacity measured.

*INORG ANAL COORD PREP 2

Preparation and Analysis of a Complex Compound
Sebera, D. K.
J. Chem. Educ. 40 ,476 (1963)
Chloropentamminecobalt(III) chloride prepared and analyzed. Detailed procedures for prep. only. Analysis by Mohr, ion exchange for remaining chloride, cobalt by redox.

*INORG ANAL COORD NOPROC PREP PROJ 2

A Project-Type General Chemistry Experiment
Thielmann, V.
J. Chem. Educ. 51 ,536 (1974)
Chloropentamminecobalt(III) chloride preparation and analysis as a project. Most has appeared earlier.

*INORG PREP STOICH 1 2

A Different Experiment on Chemical Composition
Wells, N.; Boschmann, E.
J. Chem. Educ. 54 ,586 (1977)
Synthesis of antimony iodide from metal can be used to establish formula. Easy.

*INORG QUAL 1 2

The Case of the Unlabeled Bottles: Descriptive chemistry in the introductory laboratory course
Zuehlke, R. W.
J. Chem. Educ. 43 ,601 (1966)
Given seven solutions in unlabeled bottles (with some qual. unknowns), how can mixing determine the contents? A master list of all possible substances used is also given.

*ORG GC ISOMERS PREP 3

The Dimerization of Isobutylene: A student experiment
Allen, M.; Joyner, C.; Kubler, P. G.; Wilcox, P.
J. Chem. Educ. 53 ,175 (1976)
Short note reports successful classroom repetition of Whitmore's classic dimerization on a small scale, analysis of octene isomers by GC.

*ORG CARBENE CATAL PREP PTC 3

2,2-Dichlorobicyclo(4.1.0)heptane from Cyclohexene and Dichlorocarbene by Phase Transfer Catalysis
Ault, A.; Wright, B.
J. Chem. Educ. 53 ,489 (1976)
Improved preparation (see Goh, S.H.J., J. CHEM. EDUC., 50, 678(1973)). Caution: chloroform.

*ORG NOPROC QUAL SEQ 3

The Preparation, Oxidation and Characterization of an Unknown Secondary Alcohol
Chittum, J. W.; Haynes, L. W.
J. Chem. Educ. 51 ,57 (1974)
Short note describes 3-lab period exp't where various combinations are issued for (a) formation of a Grignard reagent from an alkyl halide, (b) reaction with an aldehyde, (c) purification, then oxidation to a ketone. Identification by preparation of solid derivatives (or ir plus nmr).

*ORG GC IR NMR PREP REARRANGE 3 HAZARD

A Series of Related Organic Experiments with Optional Structure Determinations
Fairless, B. J.; Ragsdale, G.; Kerby, C.
J. Chem. Educ. 51 ,61 (1974)
Prep of allyl phenyl ether gives mix of products when strong base is used. Separate (partially) by distillation, then prep. gc. Thermal rearrangement of allyl phenyl ether, acid catalyzed rearrangement of 2-allylphenol.

*ORG GC ISOMERS NOPROC 3

A Laboratory Study of Steric and Inductive Effects
Fulkrod, J. E.
J. Chem. Educ. 51 ,115 (1974)
Nitration of different alkylbenzenes followed by gc. Results from many students pooled for discussion. Extensions.

*ORG COLOR NMR SEQ 3

Synthesis of a Photochromic Benzothiazolinic Spiropyran
Guglielmetti, R.; Meyer, R.; Dupuy, C.
J. Chem. Educ. 50 ,413 (1973)
Three steps, three periods. Caution: chloroform (solvent) is carcinogen; substitute.

*ORG FRIEDEL.CRAFTS GC REARRANGE 3

Dealkylation-Isomerization of p-di-t-Butylbenzene
Hawbecker, B. L.; Kurtz, D. W.; Elliott, H. A.
J. Chem. Educ. 55 ,777 (1978)
Aluminum chloride catalyzed dealkylation equilibria.

*ORG PHYS KEQ NMR NOPROC THERMO 3

Relative Carbonium Ion Stabilization Energies: An NMR Experiment for the Undergraduate Organic Laboratory
Kenny, D. H.; Sandel, V. R.; Osterby, B. R.
J. Chem. Educ. 51 ,253 (1974)
Stable trityl salts are used to determine equilibrium constants for one salt dissociation by nmr.

*ORG PHOTO PREP REARRANGE 3 HAZARD

The Rearrangement of 1,1-Dimethyl-1-Phenacylhydrazinium Bromide
Koga, M.; Stamegna, A. P.; Burke, D. J.; Anselme, J. P.
J. Chem. Educ. 54 ,111 (1977)
Prep. from phenacyl bromide (CAUTION: lachrymator) and dimethylhydrazine. HAZARD: toxic, absorbed into skin. Thermal and photolytic rearrangement.

*ORG PREP 3 HAZARD

Selective Reduction of Functionalized Carboxylic Acids with Borane-Methyl Sulfide: A convenient undergraduate organic experiment
Krishnamurthy, S.; Thompson, K. L.
J. Chem. Educ. 54 ,778 (1977)
Reduction of nonanoic acid and 11-bromoundecanoic acid to alcohols. HAZARDS: methyl sulfide toxic, unpleasant odor; borane, very reactive.

*ORG CONSUMERPROD PREP 3

The Preparation of Vanillin from Eugenol and Sawdust
Lampman, G. M.; Andrews, J.; Bratz, W.; Hanssen, O.; Kelley, K. Perry, D. ;Ridgeway, A.;
J. Chem. Educ. 54 ,776 (1977)
Separate preparations (title is misleading) of isoeugenol, then oxidation to vanillin, or direct oxidation of eugenol to vanillin (poor yield) or oxidation of sawdust lignin to vanillin; cellulose remaining made into paper. Nitrobenzene (CAUTION: absorbed skin) oxidant. Interesting, not easy, good chemistry.

*ORG PHYS KIN NOPROC PREP PROJ 3 4

Solvolysis of 1-Haloadamantanes: A physical organic chemistry experiment
Markgraf, J. H.; Anton, M. F.
J. Chem. Educ. 54 ,773 (1977)
1-Chloro, -bromo, -fluoro adamantanes prepared, solvolyzed in acetonitrile, ethanol, trifluoroethanol, as class project. Most by reference. See also Perkins, R., J. CHEM. EDUC., 56, 208, (1979).

*ORG PHOTO PREP REARRANGE 3

Preparation and Rearrangement of 2,3-Diphenyl-2,3-butanediol
Markgraf, J. H.; Newton, T. A.
J. Chem. Educ 56 ,344 (1979)
Photochemical reductive dimerization of acetophenone followed by acid catalyzed rearrangement and characterization of the single product.

*ORG PREP SAFETY 3 HAZARD

The Generation of Benzyne - A Warning
Mich, T. F.; Nienhouse, E. J.; Farina, T. E.; Tufariello, J. J.
J. Chem. Educ. 45 ,272 (1968)
An explosion is reported in an anthranilic acid diazotization used to prepare benzyne; a modification given here, using methylene chloride rather than THF as the solvent, is apparently safe.

*ORG PREP UVIS 3

A Merocyanin Dye Preparation for the Introductory Organic Laboratory
Minch, M. J.; Shah, S. S.
J. Chem. Educ. 54 ,709 (1977)
Two step prep. gives a dye whose color changes with polarity of solvent. Visible spectra recorded in two or more solvents.

*ORG TECHNIQUE 2 3 HAZARD

Purification of the Pesticide "Methoxychlor": A beginning organic recrystallization experiment
Mitchell, R. H.; West, P. R.
J. Chem. Educ. 52 ,805 (1975)
A Chem-Ed compact. The impurity gives a bright blue color with bromine in acetic acid; hence, it is easy to test student's product. HAZARD: pesticides are extremely toxic.

*ORG BIOCHEM PREP 3 HAZARD

The Oxidation of Ethyl Lactate
Morgan, E. D.; Goddard, H.; Thomas, G. A.
J. Chem. Educ. 54 ,782 (1977)
Pyridinium chlorochromate oxidant (HAZARD: probably carcinogenic). Simple experiment with biochemical analogies.

*ORG ANAL TLC 3

TLC on Microscope Slides: An organic chemistry experiment
Naff, M. B.; Naff, A. S.
J. Chem. Educ. 40 ,534 (1963)
Early technique experiment gives method of preparing plates; three short experiments on separation of dyes, phenols.

*ORG PREP PROJ 3

Project Orientation in the Organic Laboratory
Neckers, D. C.
J. Chem. Educ. 47 ,700 (1970)
Synthesis of dicyclopropyl ketone is followed by a variety of possible reactions, including kinetic studies, nmr, etc. from the literature or independently devised. An excellent example of the use of independent projects for a group.

*ORG GRIGNARD ORGANOMETAL PREP 3

Preparation and Spectroscopic Examination of an Organometallic Compound
Newlands, M. J.
J. Chem. Educ. 55 ,246 (1978)
Diphenylmethylsilane from methyldichlorosilane; ir, nmr, mass spectrum suggested.

*ORG PHYS KIN 3

Solvolysis of 1-Haloadamantanes
Perkins, R.
J. Chem. Educ. 56 ,208 (1979)
Varying halogen and temperature used in rate studies. See also Markgraf, J.F.; Anton, M.F., J. Chem. Educ. 54,733 (1977).

*ORG MASSPEC NMR PREP UVIS 3

Isomer Analysis by Spectral Methods
Poulton, G. A.
J. Chem. Educ. 52 .397 (1975)
Pseudo-ionone, prepared from citral, is isomerized to a mixture of alpha- and beta-ionone, analyzed by spectroscopic methods.

*ORG PREP 3 HAZARD

Esterification for the Introductory Organic Laboratory Course: A modified Dean-Stark trap
Puterbaugh, W. H.; Vanselow, C. H.; Nelson, K.; Shrawder, E. J.
J. Chem. Educ. 40 ,349 (1963)
Azeotropic removal of water using a simple Dean-Stark trap (can be made by simple glassblowing). HAZARD: benzene, a carcinogen, is chief solvent recommended.

*ORG IR MASSPEC NMR PREP 3

The Effects of Aryl Substituents on IR, NMR, and Mass Spectra of N-t-Butylbenzamides
Rubottom, G. M.
J. Chem. Educ. 51 ,616 (1974)
Variation of aroyl chloride in reaction with t-butyl amine gives solids purified by vacuum sublimation. Students measure and analyze substituent effects.

*ORG NMR 3

NMR Hammett Correlation: A laboratory experiment
Salmon, M.; Jimenez, A.; Salazar, I.; Zawadzki, R.
J. Chem. Educ. 50 ,370 (1973)
NMR spectra of a series of substituted benzaldehydes measured. Shift of aldehyde H correlates with Hammett sigma.

*ORG COURSE GC IR PROJ 3

A Laboratory Exercise for Organic Chemistry
Sands, R. D.
J. Chem. Educ. 52 ,732 (1975)
First semester organic lab. begins with fractional dist. separation of mixture of two unknowns, an alcohol and a ketone, monitored by gc. Each student does four preparations from the (separated) unknown mix.

*ORG FRIEDEL.CRAFTS IR PREP STATISTICS 3 HAZARD

Factorial Design in Undergraduate Organic Experiments
Smith, R. B.; Billingham, E. J., Jr.
J. Chem. Educ. 45 ,113 (1968)
Isomer distribution in 2-bromobutane-benzene reaction studied by quantitative ir. HAZARD: benzene is a carcinogen, substitute. Temp., amount of catalyst varied.

*ORG PREP 3

Aniline by a Modified Jones Reductor Method
Stubbs, U. S., Jr.; Atkins, C. F.
J. Chem. Educ. 36 ,611 (1959)
Modification of standard organic preparative reaction, to give continuous reduction.

*ORG PREP 3

The Small Scale Preparation of Azobenzene and of Hydrazobenzene
Vogel, A. I.; Watling, A.; Watling, J.
J. Chem. Educ. 35 ,40 (1958)
Azobenzene by reaction of nitrobenzene with magnesium and methanol. Hydrazobenzene by reduction with excess magnesium or with Devarda's alloy.

*ORG PHYS PHASE PREP 2 3

The Absorption of Light by Oriented Molecules: An experiment in organic physical chemistry
Wilson, R. M.; Gardner, E. J.; Squire, R. H.
J. Chem. Educ. 50 ,94 (1973)
Prep. of a dye which has a long axis for alignment with liquid crystal (commercially avail. material). Color depends then on orientation with respect to polarized light.

*PHYS GC PHASE THERMO 3

Gas Chromatography and Thermodynamics
Barrett, R.; Stewart, T.
J. Chem. Educ. 49 ,492 (1972)
Activity coefficients in mixtures of volatile liquids (acetone-chloroform, benzene toluene) by gc. CAUTION: benzene and chloroform are carcinogens, but could be handled safely with precautions in this experiment.

*PHYS ORG APP INTEGR KIN NOPROC PHOTO VACTEK 4 HAZARD

Photochemical Kinetics: An integrated laboratory experience
Bazley, M R. F.; Woolley, G. R.
J. Chem. Educ. 54 ,771 (1977)
Photobromination of cinnamic acid can give simple rate equation and quantum yield. Students can prepare and recrystallize cinnamic acid. Extensions to effect of inhibitors and analysis of product and its stereochemistry. Requires photolysis cell, phototube, amplifier. HAZARD: carbon tetrachloride (solvent) is carcinogen. For instructors.

*PHYS ORG COMPUTER KIN NMR 4

NMR Spectral Analysis: An experiment involving complete lineshape analysis of a two-site exchange problem
Bell, H. M.
J. Chem. Educ. 53 ,665 (1976)
Temperature-dependent studies (0-100 deg. C) of NMR spectrum of N,N-dimethylacetamide yields rate constants for group rotation, activation energy (Arrhenius plot). Mean lifetimes are found using a computer least-squares curve-fitting program.

*PHYS KIN NOPROC PHOTOCHEM 3 4

Photosensitized Oxidation by Singlet Oxygen: An adaptable photochemical system
Bell, J. A.; MacGillivray, J. D.
J. Chem. Educ. 51 ,677 (1974)
Basic reaction, oxidation of 1,3-diphenylisobenzofuran by singlet oxgyen in methanol, methylene blue sensitizer is described. Many possible experiments of varying sophistication can be devised by instructor. Rate measured colorimetrically (420 nm).

*PHYS INORG DEMO KIN OSC.RXN 2

The Color Blind Traffic Light
Boulanger, M. M.
J Chem Educ. 55 ,584 (1978)
Useful modifications to decrease induction period, Lefelhocz, J.F., J. CHEM. EDUC., 49, 312 (1972).

*PHYS DIPOLE GEOM NOPROC THERMO 3

Dipole Moments of 1,2-Disubstituted Ethanes and their Homologs: An experiment for physical chemistry
Braun, C. L.; Stockmayer, W. H.; Orwoll, R. A.
J. Chem. Educ. 47 ,287 (1970)
Conformations of disubstituted ethanes and rotational barriers from dipole moment measurements.

*PHYS CRYSTAL LASER NOPROC XRAY 3

A Practical Method of Simulating X-Ray Diffraction
Brisse, F.; Sundararajan, P. R.
J. Chem. Educ. 52 ,414 (1975)
Suggestions for student study of diffraction using He-Ne laser and masks to simulate diffraction grating, molecules, two-dimensional arrays.

*PHYS ACTIVITY KSP NOPROC 3 HAZARD

Variation of the Solubility Product Constant with Ionic Strength
Carmody, W. R.
J. Chem. Educ. 36 ,125 (1959)
Cadmium nitrate - potassium iodate titrations at various concentrations. Concentration solubility product and thermodynamic solubility product determined. HAZARD: cadmium toxicity.

*PHYS GAS 2

A Simple Gas Law Apparatus
Carter, K. N.
J. Chem. Educ. 39 ,302 (1962)
Simple method for trapping air in a glass tube and measuring pressure, volume, temperature.

*PHYS DIST PHASE TECHNIQUE 3

A Simple Method for Deriving a Boiling Point-Composition Diagram for a Binary Mixture
Coleman, H. M.
J. Chem. Educ. 49 ,471 (1972)
Toluene/acetone by distillation. Essentially identical to 1967 article.

*PHYS DIST PHASE TECHNIQUE 3

Laboratory Demonstration of Fractional Distillation
Coleman, H. M.
J. Chem. Educ. 44 ,476 (1967)
Addition of 10 percent aqueous salt solution to acetone toluene distillate mixture separates the components, permits distillate analysis. See also Coleman, H.M., J. CHEM. EDUC., 49, 471 (1972).

*PHYS POLYMER NOPROC THERMO 2 3

A Freshman Chemistry Thermodynamics Experiment: The Cyclic Rule Revisited
Dezube, B.
J. Chem. Educ. 56 ,313 (1979)
Mathematical and experimental treatment of force, elongation, and temperature of a rubber band. Thermodynamic principles. For instructors.

*PHYS ELECTROCHEM 2

An Experiment with Galvanic Cells: For the general chemistry laboratory
Dillard, C. R., Kammeyer, P. H.
J. Chem. Educ. 40 ,363 (1963)
Simply constructed test tube cell of copper, copper sulfate, salt bridge, metal, metal ion solution, for a general chemistry class or a project. Comparing two different cells allows ranking in electromotive series. Better to use a simple meter. Has been used at RPI.

*PHYS GAS KIN 3

A Simplified Apparatus for Gas Phase Reactions: Decomposition of di-t-butyl peroxide
Ellison, H. R.
J. Chem. Educ. 48 ,205 (1971)
Simplification of experiments described earlier (references given).

*PHYS APP CALORIMETRY NOPROC THERMO 3

A Thermistor Bridge Using Light-Emitting Diodes: An undergraduate thermochemistry experiment
Ferguson, A. M.; Phillips, L. F.
J. Chem. Educ. 50 ,684 (1973)
Enthalpies of neutralization; emphasis on construction of thermistor bridge circuit.

*PHYS COMPUTER DRYLAB NOPROC QUANTUM 3

A Computer Assisted Experiment in Quantum Mechanics: A physical chemistry laboratory and/or lecture
Frankel, E. C.; Davis, D. D.
J. Chem. Educ. 50 ,80 (1973)
Calculation of ionization potentials of closed shell atoms by Hartree-Fock. Requires programming experience in Fortran.

*PHYS DEMO THERMO 1 2

A Practical Energy Experiment or Lecture Demonstration
Garin, D. L.
J. Chem. Educ. 50 ,497 (1973)
Short note describes very simple experiments, more suited for non-science majors, involving many different amounts of water and studying change in temperature, etc., with time.

*PHYS GAS KIN NOPROC 2

The Rate of Oxygen Absorption by the Lungs: An Elementary Chemistry Laboratory Experiment for Biology-Oriented Students
Getzin, D. R.; Wysoczynski, W.
J. Chem. Educ. 51 ,414 (1974)
Short note describes use of commercial(?) oxygen analysis app. Air exhaled is captured in balloons, oxygen content measured after various times. Correlations with age, etc. increase student interest.

*PHYS COMPUTER DRYLAB KIN NOPROC 3 4

Analog Computer Simulation of the Methanolysis of Acetal
Giachino, G. G.
J. Chem. Educ. 55 ,201 (1978)
Students use computer to assume rate constants, examine concentration plots (and, at RPI, to compare with gc data from experiment).

*PHYS CATAL GC INTEGR NOPROC PROJ SURFACE 3

A Transition from a Traditional to a Project-Like Physical Chemistry Laboratory via a Heterogeneous Catalysis Study
Goldwasser, M. R.; Leal, O.
J. Chem. Educ. 56 ,829 (1979)
Integrated lab syllabus mostly physical, part from J. CHEM. EDUC, followed by extended project or a heterogeneous catalyst.

*PHYS, ANAL COMPUTER DRYLAB TITN 3

Location of the Equivalence Point in Potentiometric Titrations:
A simulated laboratory exercise
Kozarek, W J., Fernando, Q.
J. Chem. Educ. 49 ,202 (1972)
Gran's method (extrapolation of plots of volumes of added base give H^+ conc. vs. volume of added base) in computer simulated titrations.

*PHYS ORG DEMO PREP PROJ SURFACE 2 3

Long Lived Soap Bubbles: The Use of Sodium 9,10-Dibromostearate Solutions
Kuehner, A. L.
J. Chem. Educ. 35 ,337 (1958)
Not described as an experiment, but very suitable for student projects. Prep. of surfactant from oleic acid.

*PHYS APP ELECTROOPTIC LIQUID.CRYSTAL PHASE UVIS 4

Three Liquid-Crystal Teaching Experiments
Lalanne, J. R.; Hare, F.
J. Chem. Educ. 53 ,793 (1976)
Cells from transparent conducting plates, various liquid crystals and mixtures. Measure absorption spectra with and without field. Variation of transmission with voltage.

*PHYS COMPUTER KIN 3

Process Dynamics Experiment
Larson, M. A.; Heng, O. A.
J. Chem. Educ. 39 ,29 (1962)
Chemical engineering process dynamics measured and simulated on analog computer.

*PHYS PHASE THERMO 2

Freezing Curves for Salol
Laswick, P. H.
J. Chem. Educ. 49 ,537 (1972)
Simple cooling curves. Salol gives much supercooling, forms beautiful crystals. Salol is phenyl salicylate.

*PHYS LASER 4

Laser Experiments in Undergraduate Physical Chemistry Laboratory
Layton, R. G.; Eyring, E. M.
J. Chem. Educ. 40 ,338 (1963)
Early article giving method for measure of wavelength and energy (thermistor, Wheatstone bridge), and suggesting possible applications in experiments.

*PHYS LUMIN NOPROC SURFACE UVIS 4

Luminescence Experiments Using Adsorbed Dyes
McHale, J. L.; Seybold, P. G.
J. Chem. Educ. 53 ,654 (1976)
Alpha-naphthol and naphthalene dyes phosphoresce as well as fluoresce when adsorbed on cellulose, silica, alumina. Spectra can be recorded and phosphorescent lifetimes can be measured in experiments outlined.

*PHYS DEMO GAS 1

An Exercise with Boyle's Law
Moeller, M. B.
J. Chem. Educ. 55 ,584 (1978)
A calculation of change in volume and pressure in a system where water flows into a closed container, compressing it, is followed by a simple experimental measurement. A tested demonstration.

*PHYS GC PHASE 3 HAZARD

Determination of Liquid-Vapor Phase Diagram
Molski, N. J.; Swain, H. A., Jr.
J. Chem. Educ. 45 ,48 (1968)
Phase diagram from gc (peak height) analysis of distillate fractions. Benzene (HAZARD: carcinogen)-toluene.

*PHYS ORG PHOTO UVIS 3

Quenching of Benzophenone Triplets by Naphthalene: A physical-organic chemistry experiment
Natarajan, P.
J. Chem. Educ. 53 ,200 (1976)
Mercury vapor lamp for photochemical reduction of benzophenone in 2-propanol.

*PHYS CATAL KIN REDOX 2

Reaction Rates for a Homogeneously Catalyzed Reaction
Nechamkin, H.; Keller, E., Goodkin, J.
J. Chem. Educ. 54 ,775 (1977)
The reaction of permanganate ion with hydrogen (generated in situ from metal and acid) catalyzed by nitrate ion is measured by time for loss of permanganate color. Order of reaction with respect to permanganate and nitrate is measured.

*PHYS NOPROC PROJ THERMO 2

Relationship of Enthalpy of Solution, Solvation Energy, and Crystal Energy
Neidig, H. A.; Yingling, R. T.
J. Chem. Educ. 42 ,473 (1965)
Thermocup exp't. Solvation energies for calcium chloride and its dihydrate in three solvents (water, ethanol, methanol) from cooling curves, literature data.

*PHYS POLYMER NOPROC PROJ THERMO 3

Demonstration of PV Work by Balloon Inflation
O'Driscoll, K. F.
J. Chem. Educ. 36 ,626 (1959)
Inflating a balloon is made to displace water. Apparatus easily made, reference.

*PHYS PROJ SURFACE 3

The Measurement of Wetability: A simple method for contact angle determinations
Pirie, B. J. S.; Gregory, D. W.
J. Chem. Educ. 50 ,682 (1973)
Photographing a drop of liquid on a surface permits contact angle measurement. Suggestions for experiments are given.

*PHYS APP ISOTOPE LASER VACTEK 4

Molecular Multiple Photon Absorption: An undergraduate physical chemistry experiment in laser isotope separation
Quick, C. R., Jr.; Wittig, C.
J. Chem. Educ. 54 ,705 (1977)
CO2TEA laser (purchased or constructed) is required. Excitation of SF6 photodissociates only S-32F6, not S-34F6. Monitor by ir. CAUTION: high energy laser, high voltage.

*PHYS DIPOLE GEOM 3 HAZARD

Dipole Moments: A physical-organic experiment
Rapp, R. D.; Sturm, J. E.
J. Chem. Educ. 46 ,851 (1969)
HAZARD: Benzene used as reference is carcinogen. Substitute? Students measure dipole moment of 2-chlorocyclohexanone, calculate ratio of axial and equatorial conformers.

*PHYS APP CATAL GC KIN PROJ 4

Laboratory Research in Catalysis: Coordinating undergraduate analytical, organic, and physical chemistry
Rondini, J.; Feighan, J. A.; Downey, B. J.
J. Chem. Educ. 52 ,129 (1975)
Silica-alumina cracking catalysts, modified by metal acetonylacetate impregnation and pyrolysis, used to study rate and products of cumene catalytic pyrolysis. Temperature and catalyst varied. Used as six-week senior project.

*PHYS APP CRYSTAL XRAY 4

Laboratory Experiments in Low-Temperature X-Ray Diffraction
Rudman, R.
J. Chem. Educ. 44 ,731 (1967)
Debye-Scherer diffraction of t-butyl chloride, cyclooctanone, urea at temperatures to -140 deg. C. Interpretation from other ref.

*PHYS APP THERMO 3

Measuring the Ratio of Specific Heats of a Gas: Thermodynamic Experiments Involving Harmonic Motion
Schufle, J. A.
J. Chem. Educ. 34 ,78 (1957)
Method 1 uses oscillation time when a piston drops in a closed tube of gas. Method 2 uses audio oscillator and tube with movable piston to get standing acoustic waves, with nodes visualized by powder. Theory developed.

*PHYS APP MOL.SPECT VACTEK 4

Microwave Spectroscopy in the Undergraduate Laboratory
Schwendeman, R. H.; Volltrauer, H. N.; Laurie, V. W.; Thomas, E. C.
J. Chem. Educ. 47 ,526 (1970)
Apparatus construction (difficult), experiments on OCS structure, dipole moment of OCS, SO2, variation of linewidth with pressure, temperature, and vibrational states.

*PHYS DENSITY PROJ REFRACT VISC 3

Physical Properties of Primary Alcohols: An experience in physical chemistry
Shearer, E. C.; Rumpel, M. L.
J. Chem. Educ. 51 ,140 (1974)
Measurements of a series of primary alcohols teaches techniques and permits some correlation of properties. But not very interesting?

*PHYS ACBA COMPUTER THERMO TITN UVIS 4

Thermodynamic Analysis of a Coupled Chemical Reaction
Trimm, H.; Patel, R. C.; Ushio, H.
J. Chem. Educ. 56 ,762 (1979).
Theory discussed, not easy. Procedure in detail. Curve-fitting; dedicated microcomputer. This reaction req. titration of phenol red in buffer (both compete for H^+).

*PHYS APP KIN 3

A Simple Apparatus for Gas Reactions: The decomposition of di-t butyl peroxide
Trotman-Dickenson, A. F.
J. Chem. Educ. 46 ,396 (1969)
Reaction in a stoppered flask filled with inert gas, with an internal Bourdon gauge pressure transducer.

*PHYS COMPLEX ELECTROCHEM KSP 3

Potentiometric Determination of the "Operational" Ksp of Ag(CN)2Ag
Ungerer, B.; Jurio, R.; Manuele, R. J.
J. Chem. Educ. 49 ,434 (1972)
Silver ion titration in KI, KCN forms Ag(CN)2 ion, then AgI precipitate, finally Ag(CN)2Ag.

*PHYS ELECTROCHEM IONSELECT KSP 2 3

The Use of Specific Ion Electrodes for Equilibrium Measurements
Williams, T. R.; Boettner, W.; Wakeham, S.
J. Chem. Educ. 47 ,464 (1970)
Calibration brings activity correction. Then Ksp of CaF2, CaCO3, etc. determined.

*PHYS PROJ SURFACE 3

Colloidal Surfactants: Suggestions for practical investigations
Wood, J. A.
J. Chem. Educ. 49 ,161 (1972)
Critical micelle conc. determined by surface tension, conductance, or spectral changes of a dye. Effect of a third component, temperature, extensions.

*POLYMER COLLOID KIN VACTEK VISC 4

Polymerization Kinetics and Viscometric Characterization of Polystyrene: A physical chemistry experiment
Bradbury, J. H.
J. Chem. Educ. 40 ,465 (1963)
Vacuum line for purification of monomer and filling dilatometers. Polymerization rate (by dilatometry) as function of initiator conc. Viscometry of resultant polymer gives average mol. wgt. as function of initiator conc. Techniques require care. Caution: initiator is in a benzene solution (carcinogen). Bibliographers are uncertain why the author describes this experiment as one in "colloid chemistry".

*RADIOCHEM DECAY NOPROC 1 2

Radioisotope Generators for Introductory Laboratory Use
Crater, H. L.; Macchione, J. B.; Gemmill, W. J.; Kramer, H. H.
J. Chem. Educ. 46 ,287 (1969)
Inexpensive minigenerators designed for 22 different radiochem experiments, including detector characteristics, statistics of counting, decay, transient equilibria, gamma ray scattering, etc.

*RADIOCHEM DECAY 3

Dating of Uranium Minerals by the Specific Radioactivity of Lead
Fairhall, A. W.
J. Chem. Educ. 40 ,626 (1963)
Isolation of lead from uraninite minerals and determination of absolute counting rate permits crude determination of age. Counting efficiency measured U-238 Th-234. Two 4 hour labs. Theory in detail.

*RADIOCHEM APP 4

The Experimental Determination of Thermal Neutron Flux in the Radiochemistry Curriculum
Grant, P. M.
J. Chem. Educ. 54 ,707 (1977)
Requires a "teaching" reactor. Measurements use gold as dosimeter.

*RADIOCHEM ANAL APP 4

Photographic Method of Pulse Height Analysis: A laboratory experiment
Jurs, P. C.; Isenhour, T. L.
J. Chem. Educ. 47 ,719 (1970)
Gamma ray spectra from a sodium iodide scintillator using an oscilloscope and Polaroid camera rather than expensive multichannel analyzer. Photos are taken directly from the screen. Data for Cs-137, Mn-54, etc.

*RADIOCHEM ANAL STATISTICS 3

Quantitative Determination of Potassium by Natural Radioactivity
Knudson, G. E.
J. Chem. Educ. 44 ,694 (1967)
Requires class determination of self-absorption curve and calibration curve. End-window counter.

*RADIOCHEM PROJ XRAY 4

Teaching Moseley's Law: A classroom experiment
Lazzarini, E., Bettoni, M M
J Chem Educ 52 ,454 (1975)
241 Am and 141 Ce used for gamma irradiation of pure elements and components. X rays analyzed by Ge-Li counter, multichannel analyzer. Could be used as a class project in a radiochem lab course.

*RADIOCHEM IONX 4

A Cesium-137 Barium-137m Isotope Generator
Pinajian, J J.
J Chem Educ 44 ,212 (1967)
Ion exchange on special mesh zirconium phosphate separates parent-daughter activities in one hour experiment. Reaction conducted in Pasteur; drops (5 20) collected and counted.

*RADIOCHEM DECAY SVEX 4

A Study of Secular Equilibrium Using Ce-144--Pr-144
Semmelrogge, W F , Sicilio, F.
J. Chem Educ 42 ,427 (1965)
Aqueous Ce-144/Pr-144 mixture extracted by methyl isobutyl ketone (10 drops) after Ce(III)/Ce(IV) conversion by sodium bismuthate. Ce-144 (in organic phase) transferred to a planchet, stabilized with collodion, dried under a heat lamp and counted. Saturation activity of Ce144-Pr-144, Pr-144 decay, and Ce-144 activity from plot of total activity of initially pure Ce-144. Gamma spec or filter helps to count only Pr-144. Other solvents suggested.

*RADIOCHEM ORG PHYS APP GC 4 5

Radioactive Bromine Labeling Via Gas Chromatography
Wechter, M. A , Schmidt-Bleek, F.
J Chem Educ 45 ,150 (1968)
After thermal neutron irradiation of 1,2-dibromoethane (No details), thein-organic Br-82 is deposited on a short firebrick column. The Br-82 exchanges with alkyl halides introduced in the carrier gas that passes to an analyzing column and G-M, proportional or NaI detector. Isopropyl halides/isopropanol combinations injected into the reactor. Products analyzed by radioactivity and elution time. Exchange rates and bond dissociation energies measured.