LSC Use Only
Number: _____
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Number: 91:38
Action: _____
Date: _____

CURRICULUM PROPOSAL COVER SHEET
University–Wide Undergraduate Curriculum Committee

I. Title/Author of Change

Course/Program Title: CH 114-Basic Inorganic Chemistry
Suggested 20 Character Course Title: Basic Inorganic Chem
Department: Chemistry
Contact Person: Dr. John Woolcock

II. If a course, is it being Proposed for:

_____ Course Revision/Approval Only
__X__ Course Revision/Approval and Liberal Studies Approval
_____ Liberal Studies Approval Only (course previously has been approved by the University Senate)

III. Approvals

John C Woolcock
Department Curriculum Committee

Department Chairperson

A Kaniasty
College Curriculum Committee

College Dean *

Director of Liberal Studies (where applicable)

Provost (where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. Timetable

Date Submitted to LSC: 9/91
to UWUCC: 9/91

Semester to be implemented: Fall 1992

Date to be published in Catalog: Fall 1992

Catalog Description

CH 114 Basic Inorganic Chemistry

var 2 or 4 credits
3 lecture hours
3 lab hours
(3c-3l-4sh)

Prerequisite: CH 113 (4 credits) or CH 111 and CH 112 (2 credits)

Continuation of Concepts in Chemistry. Topics include chemical kinetics, equilibrium and thermodynamics, acids and bases, electrochemistry, coordination chemistry and descriptive chemistry of selected elements.

Catalog Description

CH 114 Basic Inorganic Chemistry — var. 2 or 4 credits, 3 lecture hours, 3 lab hours (3c-3l-4sh)

Prerequisite: CH 113 (4 credits) or CH 111 and CH 112 (2 credits)

Continuation of Concepts in Chemistry. Topics include chemical kinetics, equilibrium and thermodynamics, acids and bases, electrochemistry and descriptive chemistry of selected elements.

2. Summary of the Proposed Revisions

We are reorganizing the distribution of topics between CH 113 and CH 114 so that the topics of solid, liquid and solution states have been moved from CH 114 to CH 113 and "descriptive chemistry of the elements" is moved to CH 114. The lectures covering solubility equilibria and nuclear chemistry have been replaced in part by lectures on thermodynamics and coordination chemistry. To accommodate the inclusion of these topics and the expansion of section on descriptive chemistry of the elements, the number of lectures devoted to other topics in the course have been reduced. Finally in part IV of the syllabus, the weight given to the laboratory portion of the course has been increased slightly and the grading of daily assignments has also been included while the weighing of exams including the final has been reduced.

The two credit version of this variable credit course will be available only to those students who have taken CH 111 and 112, or its equivalent and wish to receive ACS certification of their B.S. degree. (See rationale below).

This course will be required if a student wishes to receive ACS certification of the B.S. degree. This course is not required for the B.A. degree nor if the student does not wish ACS certification of the B.S. degree. Notation to this effect will appear in the summary of requirements for the B.S. degree in Chemistry printed in the catalog.

3. Course Syllabus
(previous course syllabus attached as an appendix)

I. Catalog Description

CH 114 Basic Inorganic Chemistry — var. 2 or 4 credits, 3 lecture hours, 3 lab hours (3c-3l-4sh)

Prerequisite: CH 113 (4 credits) or CH 111 and CH 112 (2 credits)

Continuation of Concepts in Chemistry. Topics covered include chemical kinetics, equilibrium and thermodynamics, acids and bases, electrochemistry and descriptive chemistry of selected elements.

II. Course Objectives

A. Students will understand the basics of chemical kinetics and be able to derive rate laws.

B. Students will understand the basics of chemical equilibrium systems including gas phase, acid-base and complex forming types.

C. Students will also be able to perform quantitative calculations related to the composition of equilibrium systems.

D. Students will understand the characteristics of acids and bases and the principles of weak acid equilibria.

E. Students will understand the fundamental qualitative and quantitative aspects of electrochemical cells and their associated oxidation-reduction reactions.

F. Students will understand the chemistry of coordination compounds.

G. Students will understand the descriptive chemistry of the main group elements. Descriptive chemistry of the elements involves a systematic presentation of the important compounds of each element along with their reactions and properties.

H. In the laboratory, students will be able to apply the principles learned in lecture to qualitatively and quantitatively analyze experimental data they collect and explain its significance.

III. Course Outline (Lecture)

A. Chemical Kinetics: The Rates and Mechanisms of Chemical Reactions (3 lectures)

1. Reaction rates and rate laws
2. Effect of concentration and temperature on rates
3. Mechanisms

B. Chemical Equilibria: General Concepts (4 lectures)
1. Fundamental concepts of equilibria
2. Equilibrium calculations

C. The Spontaneity of Chemical Reactions: Entropy and Free Energy (3 lectures)
1. Spontaneous and non-spontaneous reactions
2. Entropy
3. Free energy

D. Acids and Bases (5 lectures)
1. Acid-base systems
2. pH scale
3. Buffer systems, weak acids and bases
4. Acid-base strength

E. Electrochemistry (4 lectures)
1. Oxidation-reduction reactions
2. Voltaic cells and standard potentials
3. Electrolytic cells and Faraday's law
4. The Nerst equation

F. Coordination Compounds (5 lectures)
   1. Basic characteristics of coordination compounds
   2. Structures of coordination compounds
   3. Bonding and color in coordination compounds
   4. Physical properties of transition metals

G. The Chemistry of Hydrogen and the s-Block Elements (4 lectures)
   1. The chemistry of hydrogen and diagonal relationships in the periodic table
   2. The alkali metals: Group 1A
   3. The alkaline earth metals: Group 2A

H. Metals, Metalloids, Nonmetals: Periodic Groups 3A and 4A (4 lectures)
   1. The elements of Group 3A-Boron and Aluminum
   2. The elements of Group 4A-C Carbon, Silicon, Tin and Lead

I. The Chemistry of Nonmetals: Periodic Groups 5A Through 7A and the Rare Gases (7 lectures)
   1. The chemistry of the elements Nitrogen, Phosphorus, Oxygen and Sulfur
   2. The chemistry of the oxides and halides of these elements
   3. Chemistry of the halogens
   4. Noble gas compounds

IV. Evaluation Methods

60% Exams-Four one-hour exams covering the material from the preceding 3 weeks. These contain multiple choice, short answer and essay questions as well as numerical problems. The fourth hour exam will be given at the time scheduled for the final exam.

10% Quizzes-Periodic announced or unannounced quizzes covering the homework assignments and recent lecture material.

5% Problem Sets-Questions or problems selected from the exercises at the end of the chapter.

25% Laboratory-Reports and quizzes from the laboratory portion of the course.

V. Required Texts

Brown, T.L.; Lemay, H.E., Chemistry the Central Science, Prentice-Hall: Englewood Cliffs, NJ, 1991.

Abraham, M.R.; Pavelich, M.J. Inquiries Into Chemistry, Waveland Press: Prospect Heights, IL 1979.

McQuarrie, D.A.; Rock, P.A. Descriptive Chemistry, Freeman: New York, 1985.

VI. Special Resources Requirements

Each student is expected to purchase a pair of safety goggles for use in the laboratory.

VII. Bibliography

Mortimer, C. Chemistry, Wadsworth: New York, 1986.

Kotz, J.C.; Purcell, K.F. Chemistry and Chemical Reactivity, Saunders: Philadelphia, 1987.

Cotton, F.A.; Wilkinson, G. Advanced Inorganic Chemistry, John Wiley and Sons: New York, 1986.
Atkins, P.W. Physical Chemistry, Freeman and Co.: New York, 1986.

Skoog, D.A.; West, D.M. Fundamentals of Analytical Chemistry, Saunders: Philadelphia, 1988.

Summerlin, L.R.; Ealy, J.L. Chemical Demonstrations: A Sourcebook for Teachers, American Chemical Society: Washington D.C., 1985.

Summerlin, L.R.; Borgford, C.L.; Ealy, J.L. Chemical Demonstrations: A Sourcebook for Teachers, Vol. 2, American Chemical Society: Washington D.C., 1987.

Articles from current issues of:
Journal of Chemical Education and Chemical and Engineering News

CH 114 Lab Schedule

General Topic	Experiment
Kinetics	Bromination of Acetone (K-2)
Equilibrium	Studies of a Precipitation Reaction (I-1)
Equilibrium	Iron(III) Nitrate and Potassium Thiocyanate (I-5)
Acids and Bases	Acid and Base Classifications (G-1)
Acids and Bases	Acetic Acid (I-3)
Acids and Bases	Acid and Base Interactions (G-2)
Electrochemistry	Electrolysis (J-2)
Descriptive Chemistry	Chemical Properties (F-1)
Descriptive Chemistry	Halogens (F-2)
Descriptive Chemistry	Qualitative Analysis of Anions and Cations (L-1/L-3)
Descriptive Chemistry	Synthesis of an Unknown Coordination Compound (Handout)
Descriptive Chemistry	Spectroscopy of Coordination Compounds (Handout)

*The code in parenthesis represents experiments taken from the required lab text: Inquiries Into Chemistry by Abraham and Pavelich.

4. Rationale/Justification for the Change

For certification of the IUP B.S. degree by the American Chemical Society's Committee on Professional Training (ACS-CPT) there must be equal emphasis placed on each area of the chemistry curriculum: analytical, organic, physical and inorganic chemistry. Also required is a systematic presentation of the descriptive chemistry of the elements as part of the inorganic curriculum. We are reorganizing the sequence of topics taught in CH 113 and CH 114 so that we can meet these requirements. Currently we have only one required semester of inorganic chemistry (CH 411) for a B.S. degree which contains no descriptive chemistry of the elements while the other areas of the chemistry curriculum have two required semesters of lectures and laboratory work. It is, therefore, necessary to modify CH 113 and CH 114 so that this sequence contains the equivalent of an entire semester of inorganic chemistry that focuses primarily on the descriptive chemistry of the elements. We also plan to change the title of CH 114 to "Basic Inorganic Chemistry" to indicate that this course will complement CH 411 and contains the bulk of the inorganic lecture and lab material in the CH 113/114 sequence. Specifically, sections III.B. and III.F. in the CH 113 syllabus contain largely inorganic topics which when combined with sections III.D.-XI. of the CH 114 syllabus results in 36 lecture hours of inorganic chemistry with 23 lecture hours on chemistry of the elements. We plan to make CH 114 a variable 2 or 4 credit course since we wish to accommodate those students who want to receive ACS certification of their degree but have already taken the CH 111/CH 112 sequence, which contains no descriptive chemistry of the elements. Thus, only those students who have taken CH 111 and 112, or its equivalent will be allowed to register for the 2 credit version of CH 114. These students will attend lectures for the second half of the semester when sections III.F.-I. are presented and will be required to do the six laboratory experiments on descriptive chemistry also presented in the second half of the semester. These students will complete all quizzes, tests and homework assignments given during this period and be graded using the same evaluation scheme used for the four credit version of the course.

V. Letters of Support:

Attached is a letter from the ACS-CPT after our most recent program review as well as a copy of the relevant portions of the ACS-CPT guidelines.

As described in the proposals for these courses, the revisions we plan to make in CH 113 and CH 114 largely involve a reorganization of topics between the two semesters as well as an expansion of the portion of the course referred to as "descriptive inorganic chemistry". As noted above virtually all of the topics in the CH 113-114 sequence previously approved by the Liberal Studies Committee in 1989 as a laboratory science course remain. However, to accommodate the expansion of the descriptive inorganic chemistry we have reduced the number of hours devoted to all other topics by 1-2 lecture hours and deleted the most advanced concepts from these chapters which are treated more successfully in advanced courses. The deletion of topics such as "phase changes", "solubility equilibria" and "titration curves" are excellent examples.

In examining the descriptive inorganic chemistry in CH 114, we feel that this new material also fulfills the Liberal Studies primary and secondary goals listed in Part II-IV of the 1988 LS application for this course. We have attached the previous Liberal Studies proposal for reference. This type of course material has a number of characteristics that make it different from the other topics. First, it is largely factual since it describes the known structures, properties and chemical reactions of the elements and their compounds, therefore the periodic table of elements is used to organize the lectures instead. Second, each family of elements and their compounds is examined in turn and compared to neighboring groups in the periodic table. Finally, selected applications of the elements and their compounds to chemical technology is also presented. Since this material is placed at the end of the second semester the concepts, theories and principles discussed in previous chapters are reviewed and applied to specific examples. Thus, this material allows us to create links from the theories and general concepts of chemistry to specific chemical and physical properties of the elements and their compounds. To complement the lectures on descriptive inorganic chemistry we plan to substitute two or three laboratory experiments in the present syllabus with ones focusing on descriptive chemistry of the elements. Other descriptive chemistry experiments we now use in the lab portion of CH 113 will be moved to CH 114 to round out the second semester.

Appendix

1. Letter from American Chemical Society's Committee on Professional Training (ACS-CPT)

2. Selected pages from ACS-CPT handbook

3. Previous course syllabus for CH 114

American Chemical Society

COMMITTEE MEMBERS

Marjone C. Caserio, Chair

Norman C. Craig — Gordon G. Hammes
Michael P. Doyle — Herbert D. Kaesz
Dennis H. Evans — Karen W. Morse
C. David Gutsche — Shalaby W. Shalaby
Gordon A. Hamilton — J.M. White
Alice J. Cunningham, Consultant

COMMITTEE ON PROFESSIONAL TRAINING
1155 Sixteenth Street, N.W., Washington, D.C. 20036

Barbara A. Gallagher, Secretary (202) 872-4589
Cathy A. Nelson, Staff Associate (202) 872-4599

March 20, 1989

Dr. Neil J. Acting, Chairperson
Department of Chemistry
Indiana University of Pennsylvania
Indiana, PA 15703

Dear Dr. Acting:

Thank you for sending us your department's 1987-88 annual and five-year re-evaluation reports. However, in preparing your report for review by the Committee, it was not apparent to us where descriptive inorganic chemistry is covered in your curriculum. If this material has been integrated into one or more courses, would you please send us the final exams for the courses where basic inorganic chemistry is covered. If ACS standardized exams were used for any of these courses, please provide profiles of your students rankings on each examination over the last two years.

Also, would you please send us your comments on where your students satisfy the ACS Guidelines requirement for synthesis and characterization of inorganic compounds beyond the level of general chemistry.

We would appreciate it if you could send this material by April 15.

Thank you for your cooperation.

Sincerely,

Barbara A. Gallagher

Barbara A. Gallagher
Secretary
Committee on Professional Training

BAG/dsh

MAR 23 1989

Undergraduate Professional Education in Chemistry: Guidelines and Evaluation Procedures

Fall 1983

AMERICAN CHEMICAL SOCIETY

COMMITTEE ON PROFESSIONAL TRAINING

The Core Curriculum

Programs of study in chemistry for majors and non-majors can be organized in many ways to reflect the institution's mission, the available facilities, and the interests and capabilities of the students and faculty. However organized, the core curriculum of an approved program (that part of the program taken by all certifiable graduates) must include roughly two semesters of study of each of four fundamental areas: analytical, inorganic, organic, and physical chemistry.

Initial studies should include an introduction to chemical principles, elementary quantitative analysis, and basic inorganic chemistry — the elementary quantitative analysis and the basic inorganic chemistry being equivalent to approximately a semester's work in each subject. Basic inorganic chemistry, whenever presented, should include descriptive chemistry dealing in a systematic way with the elements and the structures, properties, and reactions of their compounds. Portions of the core requirements might be completed in a course in general chemistry. For example, a general chemistry course with heavy emphasis on inorganic chemistry could satisfy as much as one half of the one year core requirement in that area. When parts of a general chemistry course are used to satisfy some of the core requirements, the Committee requests supporting documentation in the form of syllabi and examinations.

The remaining core material normally is covered in two semesters of organic chemistry, two of physical chemistry, one of upper level inorganic chemistry, and one of upper level instrumental analytical chemistry. Ordinarily the upper level courses in inorganic chemistry and analytical chemistry should have organic and calculus-based physical chemistry as prerequisites.

Although conventional names have been used to describe the core areas, the Committee recognizes and encourages approaches that cover the same material in different ways. All of the core courses not only must be offered but actually given on a regular schedule that enables students to take them in proper sequence.

Core courses should include examples of biochemistry, polymer chemistry, and applied chemistry, particularly if those areas of chemistry are not covered in advanced courses. Throughout the core, attention should be given to chemical safety, systematic use of the chemical literature, and computer applications.

Advanced Courses

In addition to the core, approved programs include a minimum of six semester hours of advanced work. Advanced chemistry courses are those that have a major portion of the core curriculum, usually including physical chemistry, as a prerequisite. However, a biochemistry course that uses quantitative concepts involving kinetics, thermodynamics, solution properties of macromolecules, and that has c but not physical chemistry as a prerequisite may be appropriate for che majors in approved programs. Also, some advanced organic courses (for ex advanced organic synthesis) may not require a physical chemistry prerequisi Committee does request for evaluation copies of course syllabi and exami for advanced courses that do not have a semester of physical chemistry as p uisite.

Upper level independent study and research at the post-physical chemist may be counted as advanced work, as may advanced courses in chemica neering, computer science, geochemistry, surface chemistry, mathematics, m lar biology, physics, and other allied fields. Because of the importance of bioc try and polymer chemistry, those areas should receive serious considera topics for advanced courses. However the requirement for advanced work is is essential that sufficient advanced courses be given each year in chemistry if they wish to do so, students may obtain the amount of advanced coun specified in these guidelines from among courses offered by the chemistry ment.

Curriculum Summary

In summary, an approved program is comprised of core material equiva approximately 32 semester hours equally distributed in analytical, inorga ganic, and physical chemistry and approximately six semester hours of ad study at the advanced level. About one-half of the core material in analytic inorganic, as well as all of the advanced courses, should follow at least a sem physical chemistry.

Laboratory Work

Laboratory work should give students hands-on knowledge of chemistry a self-confidence and competence to:

- plan and execute experiments through use of the literature
- anticipate, recognize, and respond properly to hazards of chemical ma tions
- keep neat, complete experimental records
- synthesize and characterize inorganic and organic compounds
- perform accurate quantitative measurements

I. CATALOG DESCRIPTION

4 credits
3 lecture hours
3 laboratory hours

CH 114 Concepts in Chemistry II

Prerequisite: CH 113

Continuation of Concepts in Chemistry I. Topics covered include the liquid and solid states, solution theory, chemical equilibrium, kinetics, electrochemistry, nuclear chemistry, and descriptive chemistry of selected elements.

II. COURSE OBJECTIVES

A. Students will understand the states of matter and the characteristic properties of them.

B. Students will understand the principles of solution theory and the properties of solutions.

C. Students will understand the basics of chemical kinetics and be able to derive rate laws.

D. Students will understand the principles of chemical equilibrium systems including gas phase, acid-base, solubility, and complex-forming types.

E. Student will be able to perform quantitative calculations related to the composition of equilibrium systems.

F. Students will understand the fundamental qualitative and quantitative aspects of electrochemical cells and their associated oxidation-reduction reactions.

III. COURSE OUTLINE(LECTURE)

A. States of Matter(7 lectures)
   1. Intermolecular forces
   2. Liquid and solid state
   3. Phase changes
   4. Solution formation
   5. Solution concentration
   6. Properties of solutions

B. Chemical Kinetics(7 lectures)
   1. Reaction rates and rate laws
   2. Effect of concentration and temperature on rate
   3. Reaction mechanisms
   4. Catalysis

C. Chemical Equilibrium(7 Lectures)
   1. Fundamental concepts and equilibrium constant
   2. Equilibrium calculations

D. Acid-Base equilibrium(8 lectures)
   1. Acid-base systems
   2. pH scale
   3. Buffer systems
   4. Titration curves

E. Solubility equilibrium(6 lectures)
   1. Common ion effect
   2. Complex ion formation

F. Electrochemistry(7 lectures)
   1. Oxidation-reduction reactions
   2. Voltaic cells and standard potentials
   3. Electrolytic cells and Faraday's Laws
   4. Nernst equation

IV. EVALUATION METHODS

50%	Three one-hour exams covering material from preceding 3-4 weeks. Numerical problems and short essay.
20%	Reports and quizzes from laboratory portion of the course.
20%	Comprehensive final exam.
10%	Periodic announced or unannounced quizzes covering recent material and homework assignments.

V. REQUIRED TEXTBOOKS

Kotz, J.C. and Purcell, K.F., Chemistry and Chemical Reactivity, Saunders, 1987

Abraham, M.R. and Pavelich, M.J., Inquiries Into Chemistry, Waveland Press, 1979

VI. SPECIAL RESOURCE REQUIREMENTS

Students are required to have suitable safety glasses for the laboratory.

VII. BIBLIOGRAPHY

Mortimer, C., Chemistry, Wadsworth, 1986

Brown, T.L. and LeMay, H.E., Chemistry: The Central Science, Prentice-Hall, 1988

Cotton, F.A. and Wilkinson, G., Advanced Inorganic Chemistry, Wiley and Sons, 1986

Atkins, P.W., Physical Chemistry, Freeman and Co., 1986

Skoog, D.A. and West, D.M., Fundamentals of Analytical Chemistry, Saunders, 1988

Summerlin, L.R. and Ealy, J.L., Chemical Demonstrations: A Sourcebook for Teachers, American Chemical Society, 1985

Summerlin, L.R., Borgford, C.L., Ealy, J.B., Chemical Demonstrations: A Sourcebook for Teachers, Vol. 2, American Chemical Society, 1987

articles from current issues of:

- Journal of Chemical Education
- Chemical & Engineering News
- Isis
- Today's Chemist

CH 114 LAB SCHEDULE
Spring 1989

Date	Experiment	Title
January 21	Handout	Check-in; Introduction to Coordination Compounds
January 28	Handcut	Synthesis and Purification of $[Co(NH_3)_4CO_3]NO_3(H_2O)_{0.5}$
February 7	Handout	Synthesis of an Unknown Coordination Compound
February 14	Handout	Spectroscopy of Coordination Compounds
February 21	L-2 & L-3	Qualitative Analysis of Anions and Cations
February 28	M-2	Water Hardness (Quantitaive Ion Analysis)
March 7	K-1	Formaldehyde Clock Reaction
March 14	SPRING BREAK	
March 21	K-2	Bromination of Acetone
March 28	Monday Classes Held - No Lab	
April 4	I-1	Properties of a Precipitation Reaction
April 11	I-4	Iron (III) Nitrate and Potassium Thiocyanate
April 18	I-3	Acetic Acid
April 25	G-2	Acid and Base Interactions
May 2	J-2	Electrolysis
May 9	LAB FINAL AND CHECKOUT	