CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

LSC Use Only	
Number	LS-63
Action	
Date	

UWUCC Use Only	
Number	
Action	
Date	

I. TITLE/AUTHOR OF CHANGE
COURSE/PROGRAM TITLE CH 101-102 College Chemistry I and II
DEPARTMENT Chemistry
CONTACT PERSON John H. Scroxton, ext. 2277

II. THIS COURSE IS BEING PROPOSED FOR:
_____ Course Approval Only
_____ Course Approval and Liberal Studies Approval
_X_ Liberal Studies Approval only (course previously has been approved by the University Senate)

III. APPROVALS

N. D. Clum
Department Curriculum Committee

12/20/88
Department Chairperson

Douglas A. Ross
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 _____
to UWUCC _____

Semester/Year to be implemented _____

Date to be published in Catalog _____

Revised 5/88

[Attach remaining parts of proposal to this form.]

LIBERAL STUDIES COURSE APPROVAL FORM

About this form: Use this form only if you wish to have a course included for Liberal Studies credit. The form is intended to assist you in developing your course to meet the university's Criteria for Liberal Studies, and to arrange your proposal in a standard order for consideration by the LSC and the UWUCC. If you have questions, contact the Liberal Studies Office, 353 Sutton Hall; telephone, 357-5715.

Do not use this form for technical, professional, or pre-professional courses or for remedial courses, none of which is eligible for Liberal Studies. **Do not** use this form for sections of the synthesis course or for writing-intensive sections; different forms will be available for those.

PART I. BASIC INFORMATION

A. For which category(ies) are you proposing the course? Check all that apply.

LEARNING SKILLS

____ First English Composition Course
____ Second English Composition Course
____ Mathematics

KNOWLEDGE AREAS

____ Humanities: History
____ Humanities: Philosophy/Religious Studies
____ Humanities: Literature
____ Fine Arts
__X__ Natural Sciences: Laboratory Course
____ Natural Sciences: Non-laboratory Course
____ Social Sciences
____ Health and Wellness
____ Non-Western Cultures
____ Liberal Studies Elective

B. Are you requesting regular or provisional approval for this course?

__X__ **Regular** ____ **Provisional** (limitations apply, see instructions)

C. During the transition from General Education to Liberal Studies, should this course be listed as an approved substitute for a current General Education course, thus allowing it to meet any remaining General Education needs? __X__ **yes** ____ **no**

If so, which General Education course(s)? CH. 101-102

PART II. WHICH LIBERAL STUDIES GOALS WILL YOUR COURSE MEET? Check all that apply and attach an explanation.

All Liberal Studies courses must contribute to at least one of these goals; most will meet more than one. As you check them off, please indicate whether you consider them to be primary or secondary goals of the course. [For example, a history course might assume "historical consciousness" and "acquiring a body of knowledge" as its primary goals, but it might also enhance inquiry skills or literacy or library skills.] Keep in mind that no single course is expected to shoulder all by itself the responsibility for meeting these goals; our work is supported and enhanced by that of our colleagues teaching other courses.

	Primary	Secondary
A. Intellectual Skills and Modes of Thinking:		
1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process.	____	X
2. Literacy--writing, reading, speaking, listening	____	X
3. Understanding numerical data	X	____
4. Historical consciousness	____	X
5. Scientific inquiry	X	____
6. Values (ethical mode of thinking or application of ethical perception)	____	X
7. Aesthetic mode of thinking	____	X
B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person	X	____
C. Understanding the Physical Nature of Human Beings	____	X
D. Certain Collateral Skills:		
1. Use of the library	____	X
2. Use of computing technology	____	X

PART III. DOES YOUR COURSE MEET THE GENERAL CRITERIA FOR LIBERAL STUDIES? Please attach answers to these questions.

A. If this is a multiple-section, multiple-instructor course, there should be a basic equivalency (though not necessarily uniformity) among the sections in such things as objectives, content, assignments, and evaluation. Note: this should not be interpreted to mean that all professors must make the same assignments or teach the same way; departments are encouraged to develop their courses to allow the flexibility which contributes to imaginative, committed teaching and capitalizes on the streangths of individual faculty.

What are the strategies that your department will use to assure that basic equivalency exists? Examples might be the establishment of departmental guidelines, assignment of repsonsibility to a coordinating committee, exchange and discussion of individual instructor syllabi, periodic meetings among instructors, etc.

B. Liberal Studies courses must include the perspectives and contributions of ethnic and racial minorities and of women wherever appropriate to the subject matter. **If your attached syllabus does not make explicit that the course meets this criterion, please append an explanation of how it will.**

C. Liberal Studies courses must require the reading and use by students of at least one, but preferably more, substantial works of fiction or nonfiction (as distinguished from textbooks, anthologies, workbooks, or manuals). **Your attached syllabus must make explicit that the course meets this criterion.**

[The only exception is for courses whose primary purpose is the development of higher level quantitative skills; such courses are encouraged to include such reading, but are not expected to do so at the expense of other course objectives. **If you are exercising this exception, please justify here.**]

D. If this is an introductory course intended for a general student audience, it should be designed to reflect the reality that it may well be the only formal college instruction these students will have in that discipline, instead of being designed as the first course in a major sequence. That is, it should introduce the discipline to students rather than introduce students into the discipline. **If this is such an introductory course, how is it different from what is provided for beginning majors?**

January 31, 1989

Subject: Response to Questions Raised by the Liberal Studies Committee

To: Dr. Charles Cashdollar, Director
Liberal Studies Program

From: Dr. Neil J. Asting, Chairperson
Department of Chemistry

In response to your memo dated January 20, 1989 which listed four areas of concern identified at the January 19 meeting of the University-wide Liberal Studies Committee, I would like to provide you with the following information.

Concern #2: that you provide stronger, more complete answers to III-b relating to gender and minorities. This we believe, was also a request of your College committee:

In general, the concepts which are the foundation for chemistry and that are covered in CH 113/114, CH 111/112, and CH 101/102 were developed during a time when women and minorities were not significantly represented in the scientific community. During the last 25 years or so, this pattern has changed dramatically and contributions from these groups are now an important part of modern chemistry. However, given the vertical nature (ie., sequential, one concept building upon another) of the science of chemistry, it would be impossible to introduce contributions from this group to freshmen students. Simply, freshmen would not possess the background to comprehend the significance of the advanced studies produced by this group of chemists. Of course, we take special care to inform all students, especially those that have an aptitude for science, of the limitless opportunities that are available to everyone today in the science of chemistry.

The faculty in the department feel that chemistry is an abstract science and issues dealing with gender and/or minorities are really not appropriate and, in fact, would detract from the subject. While we may discuss concepts such as Charles' Law, Plank's Constant or the Curie Law of paramagnetic susceptibility, we do not discuss Charles, Plank or Curie as persons. Individuals; male, female or minorities, are simply identified as scientists (we try only to use last names) who have made contributions to the area of Chemistry. Gender or race is immaterial. Our goal to focus only on the actual science of chemistry itself also extends to assignments and evaluation instruments. Problems or exam questions are never constructed using he/she or him/her. When it is necessary to refer to a person, words such as "student", "chemist", "you", etc. are used. Most often we even by-pass these terms. Usually, homework problems or exam questions are constructed without reference to anyone (ie., "calculate the number of grams of sodium hydroxide required to prepare 250 milliliters of a 0.35 molar solution.").

Concern #4: that for the three proposals requesting an exemption from the booklenght reading requirement, you provide brief, written answers to the following questions:

Question (4a): What is the level of mathematical skills required and practiced in each course?

Answer (4a.1): CH 113/114, Concepts in Chemistry

The freshman chemistry majors that take these courses are required to become proficient with or in some cases learn for the first time the following:

#1. Manipulation of algebraic type expressions (simple to complex)
#2. logarithms (common and natural)
#3. antilogarithms
#4. exponential functions
#5. quadratic equations
#6. "word" type chemical problems which require the student to read, understand, analyze and then formulate solutions which in some cases require multiple steps
#7. dimensional analysis
#8. chemical data analysis via construction of graphs
#9. significant figures
#10. scientific (exponential) notation
#11. conversion of non-linear equations into linear forms
#12. the significance of the terms: dependent variable, independent variable, slope & intercept and how these quantities relate to mathematical equations which describe natural chemical phenomena
#13. The use of commercial software to process and graph laboratory data.

Answer (4a.2): CH 111/112, General Chemistry

The vast majority of students that take this sequence are science majors (Biology, Geoscience, Physics, Medical Technology, Pre-med, Pre-vet, Pre-engineering, etc.). These students are also expected to become proficient with or in some cases learn for the first time the same basic mathematical concepts and skills outlined above for CH 113/114. The main differences are in lecture (slightly less coverage and intensity), lack of computer equipment for processing laboratory data, and laboratory experiments that are scientifically (and mathematically) less challenging than those used in the major's course. Overall however, CH 111/112 and CH 113/114 are very similar and are equated when changes in major occur.

Answer (4a.3): CH 101/102, College Chemistry

The majority of students who take these courses are from the College of Human Ecology and Health Sciences although students from other colleges will occasionally enroll. The students in this

sequence are required to become proficient with or in many cases learn for the first time the following:

#1. Manipulation of simple algebraic type expressions
#2. "word" type chemical problems which require the student to read, understand, analyze and then formulate solutions
#3. dimensional analysis
#4. chemical data analysis
#5. significant figures
#6. scientific (exponential) notation

Question (4b): What is the frequency and form of assignments and/or activities involving quantification

Answer (4b.1): CH 113/114, Concepts in Chemistry

The freshman chemistry majors receive a large dose of assignments in which all of the activities cited in (1a) above play a very large part. Specifically, activities involving mathematics occurs both in the laboratory (about 12 experiments & corresponding laboratory reports, and 6-8 quizzes per semester) and in the lecture portion of these courses (lecture discussions, 8-10 homework assignments per semester, 6-8 quizzes per semester, 3 hour exams per semester and a comprehensive final exam). Although exact frequencies are difficult to determine, it is estimated that there is about 60% involvement in quantification activities in the laboratory and about 50% involvement in the lecture.

Answer (4b.2): CH 111/112, General Chemistry

As noted above, CH 111/112 is quite similar to the CH 113/114 sequence and the students taking these courses are also exposed to a considerable amount of applied mathematics. Specifically, activities involving mathematics occurs both in the laboratory (about 12 experiments & corresponding laboratory reports, and 6-10 quizzes per semester) and in the lecture portion of these courses (lecture discussions, 8-10 homework assignments per semester, 6-8 quizzes per semester, 3 hour exams per semester and a comprehensive final exam). However, as noted in (1b) above, the experiments chosen for General Chemistry tend to to less challenging than those used in CH 113/114. Thus the frequency of activities involving quantification in the laboratory is somewhat less than that for the major's course. We estimate that there is about 50% involvement in these activities in the laboratory but still about 50% involvement in the lecture.

Answer (4b.3): CH 101/102, College Chemistry

The exposure to activities involving quantification occurs both in the laboratory (experiments, lab reports and lab quizzes) and in

the lecture portion of these courses (interactive lecture discussions, homework assignments, quizzes, hour exams and a final exam). Although exact frequencies are difficult to determine, it is estimated that there is about 40% involvement in quantification activities in the laboratory and about 33% involvement in the lecture.

Question (4c): What part does this quantitative work play in the evaluation/grading of students

Answer (4c.1): CH 113/114, Concepts in Chemistry

As indicated above, the amount of instruction and assignments that the freshman chemistry majors receive regarding the application mathematics to solve chemical problems is very large. It would be difficult to ascertain exactly how much quantitative work plays in the determination of grades for students. However, the bottom line is that if a student doesn't master these skills, they will not be able to obtain passing scores on assignments (see 2a) and exams and quizzes. Failure for the entire course must occur.

Answer (4c.2): CH 111/112, General Chemistry

As in (3a) above. Students who fail to master the applied mathematical skills taught in these courses will be unable to obtain passing scores. Failure of the entire course is the only possible outcome.

Answer (4c.3): CH 101/102, College Chemistry

It would be difficult to ascertain exactly how much quantitative work plays in the determination of grades for students. However, students who fail to master these skills, will have a difficult time obtaining passing scores on the assignments noted above (see 2c) and, hence, failure for the entire course is likely.

LIBERAL STUDIES COURSE APPROVAL

The Chemistry Department submits CH 101-College Chemistry I and CH 102-College Chemistry II as a two-semester natural science sequence, with a laboratory in each course.

PART I - BASIC INFORMATION

A. We propose this in the category of natural sciences: laboratory course.

B. We are requesting regular approval for this course.

C. During the transition from General Education to Liberal Studies, CH 101-102 should be listed as an approved substitute for the current General Education courses, CH 101-102.

PART II - WHICH LIBERAL STUDIES GOALS WILL YOUR COURSE MEET?

A. Intellectual skills and modes of thinking:

3. Understanding numerical data is a primary goal. Many of our laboratory exercises involve the collection of numerical data from which calculations are made. In the lecture portion, calculations of many types are carried out. Problem solving is the major thrust of the homework assignments. Various quantitative skills are taught and used throughout the year.

5. Scientific inquiry is also a primary goal. The "scientific method" is introduced in the first lecture. Laboratory exercises also use this technique. We attempt to show how this is used not for science alone, but how to use it in the systematic solution of everyday problems.

B. Acquiring a body of knowledge or understanding essential to an educated person. We attempt to show that an understanding of the complex nature of science and technology in today's society requires a large body of facts and figures. These must then be analyzed and choices made on the basis of the data available. Students are encouraged to associate chemistry with their own lives.

PART III - DOES YOUR COURSE MEET THE GENERAL CRITERIA FOR LIBERAL STUDIES?

A. Since this is a multiple section, multiple-instructor course, we attempt to maintain equivalency among sections in the following ways:

1. A course coordinator is assigned for a period of at least two years.

2. All sections use the same: a. syllabus b. textbook c. laboratory manual.

3. All lecture instructors agree to count laboratory work as 25% of the course grade.

4. All instructors meet periodically to discuss the course.

B. CH 101-102 discusses concepts. However, whenever appropriate, contributions of minorities and women are acknowledged.

C. Justification of an exception to the reading requirement.
The primary purpose of CH 101-102 is the understanding and application of scientific concepts and principles. Many of these involve the development of higher level quantitative skills.

D. The CH 101-102 sequence is an introductory sequence not intended for majors. It is intended for the non-science student. No previous chemistry course is assumed and no prerequisite is required. The basic fundamental principles and concepts of inorganic, organic and biochemistry are presented with the thought that this will be the students only formal college instruction in these areas.

E2. Problem solving skills are developed through the laboratory experience and the written reports for each laboratory exercise.

3. Communication skills are enhanced through classroom and laboratory discussions. Writing skills are essential for clear and concise laboratory reports.

4. The analysis of laboratory data is often followed by the formulation of a hypothesis. This is creative thinking.

5. Students are encouraged to become comparison shoppers by reading and comparing labels on both brand name items and store brand items. They are also encouraged to read and to use their scientific method of inquiry in making objective decisions in society.

E. The Liberal Studies Criteria indicate six ways in which all courses <u>should</u> contribute to students' abilities. **To which of the six will your course contribute? Check all that apply and attach an explanation.**

____ 1. Confront the major ethical issues which pertain to the subject matter; realize that although "suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.

__X__ 2. Define and analyze problems, frame questions, evaluate available solutions, and make choices

__X__ 3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.

__X__ 4. Recognize creativity and engage in creative thinking.

__X__ 5. Continue learning even after the completion of their formal education.

____ 6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

PART IV. DOES YOUR COURSE MEET THE CRITERIA FOR THE CURRICULUM CATEGORY IN WHICH IT IS TO BE LISTED?

Each curriculum category has its own set of specific criteria in addition to those generally applicable. The LSC provides copies of these criteria arranged in a convenient, check-list format which you can mark off appropriately and include with your proposal. **The attached syllabus should indicate how your course meets each criterion you check. If it does not do so explicitly, please attach an explanation.**

CH 101 College Chemistry I each 3c-2l-4sh

The basic fundamental principles and concepts of inorganic chemistry are developed from the standpoint of atomic and molecular structure with illustrative examples from descriptive chemistry. The laboratory portion of the course illustrates physical and chemical properties in a qualitative and quantitative manner. The course is designed for selected majors within the College of Human Ecology and Health Sciences.

CH 102 College Chemistry II 3c-2l-4sh

The basic fundamental principles and concepts of organic and biochemistry is developed. Deals primarily with structural features of organic compounds, the chemistry of functional groups, and practical examples and uses of organic compounds. The laboratory portion illustrates properties and reactions of representative organic compounds. The course is designed for selected majors within the College of Human Ecology and Health Sciences.

COURSE SYLLABUS
CH 101
Inorganic Chemistry

The Science of Chemistry. 2 lectures
Introduction; the scientific approach.

Methods of Measurement. 3 lectures
British system; metric system; conversions from metric to British system; mass and weight; density; specific gravity; temperature; significant figures.

Fundamental Concepts of Chemistry. 3 lectures
Definition of chemistry; matter, elements, compounds, and mixtures; states of matter; physical and chemical properties; physical and chemical changes; chemical energy; important energy transformations; conservation of energy and matter.

The Structure of Matter. 3 lectures
Law of Definite Proportions; Law of Multiple Proportions; atomic weights; subatomic particles; emptiness of matter; isotopes; mass numbers and atomic weights.

The Elements and the Periodic Table. 6 lectures
Distribution of common elements; symbols of the elements; classification of the elements; periodicy of the elements; periodic table; atomic structure and the periodic table; activity of the elements.

Compounds and Chemical Bonds. 3 lectures
Electrovalency of ionic bonds; writing formulas for compounds; covalent bonds; polar covalent bonds; electronegativity; valence and oxidation number; multiple valences, polyatomic ions.

Chemical Equations. 6 lectures
Chemical changes; chemical equations, gram atomic, molecular and formula weights; the mole concept; weight relationships; types of stoichiometry chemical reactions.

Solutions. 3 lectures
Types of solutions; solvents and solutes; factors affecting solubility; factors affecting rates of solubility; miscible and immiscible liquids; properties of solutions; osmosis; concentration of solutions; saturated solutions; supersaturated solutions; molar solutions and molarity.

Acids, Bases, Salts, and Ionization. 3 lectures
Electrolytes and nonelectrolytes; acids, bases, and salts, equivalent weights, normal solutions; titrations of acids and bases; pH buffers; indicators.

Colloids. 2 lectures
The size of colloidal particles; types of colloidal systems; why do colloids remain in suspension; properties of colloids; precipitation of colloids.

The Properties of Gases. 3 lectures

Robert Boyle and the relationship of pressure to volume; the relationship of volume to temperature--Charles' Law; the relationship of temperature to pressure; combined effects of temperature and pressure--standard conditions; diffusion of gases--Graham's Law; Gay-Lussac and the law of combining volumes; Avogadro's Law; the kinetic theory of gases.

Radioactivity and Nuclear Chemistry. 3 lectures

The hopes of the alchemists; the discovery of radium and radioactivity; half-life of radioactive elements; man-made transmutations; types of nuclear reactions; radioactive isotopes, radiocarbon dating; man-made elements; the dangers of radiation.

2 lecture periods for hour exams.

COURSE SYLLABUS
CH 102
Organic Chemistry and Biochemistry

The Nature of Organic Compounds. 3 lectures
Early experiments; vital force and synthetic compounds; isomers; importance of structure; carbon bond angles; rotation on carbon bonds; writing structural formulas; ring compounds.

Saturated Hydrocarbons; The Alkanes. 4 lectures
Petroleum, a source of saturated hydrocarbons; development of names; the systematic names; general physical and chemical properties; combustion; substitution by chlorine; the nature of alkane reactions; names of alkyl halides; common organic halides; relation of alkanes to other organic compounds.

Unsaturated Hydrocarbons; Alkenes and Alkynes. 3 lectures
Structure and occurrence of alkenes; source and uses of alkenes; alkene names; cis-trans isomers; alkene reactions; alkynes; acetylene (ethyne).

Aromatic Hydrocarbons; Benzene and Related Compounds. 3 lectures
Type of structure; names; general chemical properties; reaction with chlorine or bromine; reaction with sulfuric acid; reaction with nitric acid; oxidation of side chains; heterocyclic compounds; sources of aromatic compounds.

Alcohols, Phenols, and Ethers. 3 lectures
Alcohol names; common alcohols; physical properties of alcohols, phenols, and ethers; chemical properties of alcohols; phenols; ethers.

Carboxylic Acids. 4 lectures
Acidic properties; salt formation; water solubility of carboxylic acids and salts; reaction with alcohols; esterification; common esters, natural and synthetic; hydrolysis and saponification of esters; formation and reactions of acid chlorides; sources of acids.

Carbonyl Compounds-Aldehydes and Ketones. 4 lectures
Names of aldehydes and ketones; physical properties; synthesis from alcohols; important carbonyl compounds; chemical reactions.

Amines and Amides. 3 lectures
The relatives of ammonia; basic properties; preparation of amines; conversion of amines to amides; chemical properties of amines and amides; names of amines and amides; nitrogen-containing drugs.

BIOCHEMISTRY

Introduction to Biochemistry. 3 lectures
Development of biochemistry; biochemical composition; biochemical reactions.

The Chemistry of Carbohydrates. 3 lectures
Monosaccharides; compounds related to monosaccharides; disaccharides; polysaccharides.

The Chemistry of Lipids. 3 lectures

Structure and hydrolysis of fats; fatty acid constituents; fats and oils, hydrogenation of oils; saponification; the solubility and cleansing action of soaps; synthetic detergents; classification of lipids, triglycerides, phospholipids, steroids.

The Chemistry of Protein. 4 lectures

Amino acids; peptides and polypeptides; protein structure; protein denaturation.

2 lecture periods for hour exams.

College Chemistry - CH 101

Laboratory Investigations

1. Density and Specific Gravity
2. Investigating Chemical and Physical Properties
3. Law of Definite Composition
4. Atoms, Compounds and Chemical Reactions
5. Principles of Combustion
6. Study of Commercial Soap Products
7. The Activity of Metals
8. The Analysis of Water
9. Solutions and Colloids
10. Titration and Determination of the % Acetic Acid in Vinegar
11. Weights of Equal Volume of Gases

College Chemistry - CH 102

Laboratory Investigations

1. Test for the Detection of the Common Element Present in Organic Compounds
2. Identification of Organic Compounds Using Boiling and Melting Points
3. Hydrocarbons - Preparation and Properties
4. Paper Chromatography
5. Molecular Models - Structural Formulas and Isomerism
6. Alcohols and Their Properties
7. The Physical and Chemical Properties of Organic Acids
8 Preparation and Properties of Aldehydes and Ketones
9. Distillation of an Alcohol/Water Mixture
10. Esterification and Aspirin Preparation
11. Identification and Hydrolysis of Carbohydrates
12. Proteins

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Understanding Chemical Reactions; M.C. Day and Barry Corona; Allyn & Bacon 1986.

Teaching Chemistry with Models; R.T. Sanderson; D. Van Nostrand Co. 1962.

Brief Chemistry of the Elements; James L. Hall; W.A. Benjamin 1971.

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