SM 7/8/67

Carried

SIMON FRASER UNIVERSITY

MEMORANDUM

Paper S-24

To Mr. D. P. Robertson,
Secretary of Senate.

From K. E. Rieckhoff,
Acting Dean of Science.

Subject New Chemistry Curriculum.

Date July 26, 1967.

At its meeting of July 25, 1967, the Faculty of Science moved adoption of the new Chemistry program as submitted in document 7-G. The motion was passed unopposed with one abstention.

Document 7-G is attached.

K. E. Rieckhoff.

pt

attach.

SM 718/67

7 - C
Calendar

The Proposed Program to be Offered by the Department of Chemistry

After lengthy deliberation the Department of Chemistry presents the following document describing the proposed changes in the course offerings of this Department.

It will be noted that the changes are of a nature sufficient to alter both the design and the content of the total program. For this reason we give details not only of new courses but of the whole program. We discuss the reason for the proposed changes and the relationship of the new courses to the old courses. We comment upon the relationship of the proposed course to the Chemical Physics and Biochemistry programs.

This program has been structured with great care and deliberation. For reasons discussed below we wish this program to be accepted at this meeting of Senate so that it may become the program presented by the Department of Chemistry as and from September 1st, 1967.

Summary of proposed changes.

a) That the present courses labelled 101-3 and 105-2 shall be regarded as preliminary make up courses, not part of the degree program proper.

b) That the present course, Bonding, Structure and Stereochemistry (Chem 201-3), be somewhat modified in content and renumbered 103-3.

c) That the present course Organic Chemistry I, Chem 251-3, be supplemented by a further 200-level course, Organic Chemistry II, Chem 252-3 (presently 451-3).

d) That a 200-level course in Inorganic Chemistry shall be introduced, namely 231-3, Inorganic Chemistry I, and regarded as part of the "core" program for both Honors and Major students.

e) That the present Physical Chemistry course 461-3, Physical Chemistry II, shall be withdrawn and that two Physical Chemistry courses 361-3 and 362-3 be regarded as core program courses.

f) That the presently offered course 441-3, Nuclear and Radiochemistry shall be withdrawn and that a course 341-3, Radiochemistry, shall become part of the core degree program and that a course 442-3, Nuclear Chemistry, shall be available as an Elective.

SM 718/69 Calendar

g) That 452-3 Structure and Mechanism in Organic Chemistry be renumbered 351-3 and become part of the core program.

h) That two new senior level Organic Chemistry courses be added as electives. These are Chemistry 453-3 Stereochemistry and 454-3 Advanced Organic Chemistry.

The relationship between the old course number and the new course number is given below.

Our previous program was written

Core Program 38 hours Chemistry
15 hours Physics
15 hours Maths

plus:

Chemistry Major 52 semester hours of electives at least 25 hours of which must be at the 300-level or above (leaving 27 hours of free electives).

Chemistry Honors 40 semester hours of chemistry electives (or related courses) and 24 hours of free electives.

The presently proposed program shall read

Core Program 47 hours Chemistry
15 hours Physics
15 hours Maths

Chemistry Major 43 hours of electives, 33 of them being "Free" Electives.

Chemistry Honors 30 semester hours of chemistry electives (or related courses), 5 hours of undergraduate research and 20 hours of free electives.

General discussion on the proposed changes.

The changes proposed are sufficient that it might better be said that this Department is presenting a new program for the undergraduate teaching of Chemistry. It was recognised some while ago that certain changes were necessary as it was obvious that certain courses presented the student with an excess of material. It was also realised that the way in which the program was presented failed to make best use of the trimester system. With the experience of having taught most of our course offerings for some two years, we now see it possible to present our courses (by carefully structuring the material presented) such that in one semester the student develops the maximum maturity with respect to the material given. In essence we feel we have broken away from the false image that two semesters are equivalent to "one year".

SM 7/8/67 Calendar

Apart from a natural development from our originally planned course, two recent events have made it necessary that an immediate change in course program be instituted. The first of these arises from the new High School CHEM 12 and CHEM 11 programs. It is obvious that students from the program should be able to orient themselves to the present Chemistry 102-3 level and possibly, a small number, to certain courses in the present 200-level chemistry program. There is, however, still a demand for a course suitable for students with no previous training in chemistry, from CHEM 11, or students from CHEM 12 who prefer to orient themselves into our University while taking a course which is less demanding for them. There is also the student from another Department in the Faculty of Science or perhaps from another Faculty who wishes to avail himself of a "beginners" course in Chemistry. We wish to accommodate these students by retaining the present CHEM 101-3 and the laboratory course CHEM 106-2 in the course offerings but not accepting these in the degree program in CHEMISTRY.

The second "event" is the undoubted need to allow students pursuing a major or honors degree in Chemistry more freedom in their choice of courses outside the Faculty of Science. This is particularly so in view of the proposed resurgence of the "General Education - Network" program on Campus wherein it is hoped that some worthwhile courses, and not mere "liberality - course-fillers", will exist. We think we have achieved this "relaxing" of our program by our re-assessment of the content and aim of our courses, by a better balance of the choice of courses over the eight semesters.

It is also pleasant to report that the proposed program now appears easily acceptable by the Chemical Institute of Canada as a course leading to an Honors Degree. Our previous program fell a little short of the C.I.C. requirements. This is essentially a professional requirement (and may have some bearing upon the student's later standing in an Industrial career) but the acceptance of our program argues well for our Graduates being accepted into Graduate Programs at other Universities.

We feel that the proposed program compares favorably with Chemistry programs at other Universities. It appears to integrate well in to the programs offered by other Departments in the Faculty of Science. It is obviously a program that for an Honors student is very demanding but it has, nevertheless, been constructed such that his progress through the program is logical. It leads from a general view of chemistry in an essentially descriptive manner through the conceptual scientific methodology of Inorganic, Physical and Organic Chemistry with a gradual increase in the mathematical description of Chemistry to the final confrontation with the formal disciplines of theoretical chemistry.

SM 7/8/69 Calendar

Old Course #		New Course #	
101-3	General Chemistry I	101-3*	General Chemistry I
			*No longer in Core course program for Chemistry
102-3	General Chemistry II	102-3	General Chemistry II
106-2	Introductory Laboratory	106-2*	Introductory Laboratory
			*No longer in Core course program for Chemistry
116-2	Qualitative Analysis Lab	116-2	General Chemistry Laboratory
201-3	Bonding, Structure and Stereochemistry	103-3	Bonding, Structure and Stereochemistry
216-2	Quantitative Analysis Lab	117-2	Quantitative Chemistry Lab
	No Equivalent	231-3	Inorganic Chemistry I
251-3	Organic Chemistry I	251-3	Organic Chemistry I
451-3	Organic Chemistry II	252-3	Organic Chemistry II
256-2	Organic Chemistry Lab I	256-2	Organic Chemistry Lab I
261-3	Physical Chemistry I	261-3	Physical Chemistry I
431-3	Inorganic Chemistry I	331-3	Inorganic Chemistry II
436-2	Inorganic Chemistry Lab I	336-2	Inorganic Chemistry Lab I
	No Equivalent	341-3	Radiochemistry
452-3	Structure and Mechanism in Organic Chemistry	351-3	Structure and Mechanism in Organic Chemistry
456-2	Organic Chemistry Lab II	356-2	Organic Chemistry Lab II
461-3	Physical Chemistry II	361-3 362-3	Physical Chemistry II Physical Chemistry III
466-2	Physical Chemistry Lab I	366-2	Physical Chemistry Lab I
467-2	Physical Chemistry Lab II	367-2	Physical Chemistry Lab II
421-3	Biochemistry I	421-3	Descriptive Biochemistry
422-3	Biochemistry II	422-3	Physical Biochemistry
426-2	Biochemistry Lab I	426-2	Biochemistry Lab I
427-2	Biochemistry Lab II	427-2	Biochemistry Lab II

SM 7/8/67 Calendar

Old Course#		New Course#	
432-3	Inorganic Chemistry II	432-3	Inorganic Chemistry III
437-2	Inorganic Chemistry Lab II	437-2	Inorganic Chemistry Lab II
441-3	Nuclear and Radiochemistry		No Equivalent
442-3	No Equivalent	442-3	Nuclear Chemistry
446-2	Nuclear Chemistry and Radiochemistry Lab	446-2	Nuclear Chemistry and Radiochemistry Lab
	No Equivalent	453-3	Stereochemistry
	No Equivalent	454-3	Advanced Organic Chemistry
457-3	Modern Laboratory Techniques in Organic Chemistry	457-3	Modern Laboratory Techniques in Organic Chemistry
462-3	Molecular Spectroscopy	462-3	Molecular Spectroscopy
468-2	Physical Chemistry Lab III	468-2	Advanced Physical Chemistry Lab
471-3	Quantum Chemistry	471-3	Quantum Chemistry
481-5	Undergraduate Research	481-5	Undergraduate Research

Detailed Comments upon some of the proposed changes

1. Chem 101-3; Chem 106-2

In structuring our first and second year programs we are faced with a number of problems arising from the varying backgrounds of the students entering S.F.U. Students enter with no chemistry, with Chem 11, with Chem 12 and with Chem 112. The first students from the new CHEM 12 enter this fall and it is clear that the majority of these students can enter directly into CHEM 102. Some of those coming from CHEM 112 may be of sufficiently high calibre to enter the program beyond this point. The new structuring of our 200-level courses makes this now possible. There exists, however, a great need to retain the present Chem 101-3 and Chem 106-2. Students entering from CHEM 11 undoubtedly need this course and many even with CHEM 12 may prefer to spend one semester at this level rather than be faced with both a new environment and new conceptual material. Both CHEM 101-3 and CHEM 106-2 can now further satisfy the undoubted need of students NOT perhaps in the Faculty of Science but who wish to indulge themselves in a physical science, perhaps for the first time. These courses will satisfy this need as their emphasis is an introduction to the scope aims and methods used in the physical sciences.

SM 7/8/69

Calendar

2. As in our previous program a Chemistry Major student is faced in his first two semesters with the choice of taking either 5 courses (14 credit hours) or 6 courses (17 credit hours). We appreciate this dilemma, and have made a move towards its solution. We first point out that in many Universities no credit-hour rating is given for laboratory course work. We feel that in time we too can adopt this procedure but the implementation of this must await changes both with the programs presented by the other Departments in the Faculty of Science and in the present concept of the "core course" structure. We hope that it may soon be both financially and spacially possible to offer courses in the Faculty of Science outside the Departmental Honors or Majors program, courses, in fact, designed for both science and non-science students. We have attempted to alleviate the 5 or 6 course dilemma by radically restructuring our 100 and 200 level laboratories. These are essentially technique-learning laboratories with experiments designed to illuminate salient points in the related lecture courses. This demands but little else from the student than the 4-hour duration of the laboratory class though provision is made in the design of the courses to allow motivated students to achieve somewhat higher goals. The upper-level laboratories have been structured in a manner that radically departs from tradition. These laboratory courses assume the student is ready to approach Chemistry as an experimental science. They are aimed to allow the student to exercise judgment and initiative in the actual design of experiments. A far higher degree of correlation between theory and practical work is demanded together with an appreciation of the current research literature. Creativity and intellectual exercise is demanded in these upper level laboratories We wish to point out that this degree of creativity in the physical sciences can only be enjoyed if the student has already acquired a firm understanding of the theoretical concepts introduced in the earlier lecture courses. Our program is so structured that a student can, in fact, achieve the necessary mental maturity to obtain the maximum benefit from these laboratory courses. With this in mind we have made the changes in the Physical Chemistry and Organic Chemistry courses as discussed above. The inclusion of Chem 351-3, 361-3 and 362-3 as core course programs now allows a student to become acquainted with certain areas of chemistry (e.g. Statistical Mechanics and Quantum mechanics) that in our previous program could only be taken by the student as elective courses.

3. Radiochemistry Course Changes

The present Chem 441 course (Nuclear and Radiochemistry) has now been divided into two:

Chemistry 341 (Radiochemistry) is intended to be a course of general chemical interest and will contain all the material on radiochemistry previously offered in Chemistry 441 and elsewhere. A second course, Chemistry 442 (Nuclear Chemistry), will be more specialised and is <u>not</u> expected to be of interest to every Chemistry Honors student.

JM 7/8/69

The need for the proposed break up of Chem 441 into two courses at different levels is obvious. Whereas the proposed CHEM 442 will be of a standard even to serve as a course to prepare Graduate students in basic material in nuclear chemistry (i.e. it will lead directly into Chem 841 and Chem 842 in Graduate program) it is hoped that CHEM 341 will be of interest to a wide range of undergraduate students. The prerequisites for the course, for non-chemistry students, are designed to make this course available to the widest possible range of students.

4. Honors Chemical Physics Program

The changes in this course are minimal and involve only a one unit change in the overall credit rating of the program. Chem 101-3 and Chem 102-2 are no longer recognised as part of the Chemical Physics program, these are replaced by Chem 231-3 and Chem 252-3. The Chemical Physics program compares even more closely with the Honors program in the two parent programs.

5. The Biochemistry Programs

The Biochemistry program has been designed recognising the proposed changes in the program of the Chemistry Department. A calendar entry for this program has been included in the overall calendar entry of the Chemistry Department.

SM 7/8/67

Calendar

SIMON FRASER UNIVERSITY
DEPARTMENT OF CHEMISTRY

B.D. Pate	B.Sc., M.Sc. (London), Ph.D. (McGill), Professor and Head.
D.G. Tuck	B.Sc., Ph.D. (Durham), F.R.I.C. Professor.
A.M. Unrau	B.S.A., M.S.A. (Brit.Col.), Ph.D. (Minnesota), Professor.
T.N. Bell	B.Sc., Ph.D. (Durham), Associate Professor.
Y.L. Chow	B.Sc. (National Taiwan), Ph.D. (Duquesne), Associate Professor.
John Walkley	B.Sc., Ph.D. (Liverpool), Associate Professor.
E.J. Wells	B.Sc., M.Sc., (Sydney), D.Phil. (Oxon), Associate Professor.
M.L. Benston	B.A. (Willamette), Ph.D. (Washington), Assistant Professor.
F.W.B. Einstein	B.Sc., M.Sc., Ph.D. (Canterbury, N.Z.), Assistant Professor.
N. Flitcroft	B.Sc., M.Sc., Ph.D. (Manchester), Assistant Professor
I.D. Gay	B.Sc., M.Sc. (Dalhousie), Ph.D. (London), Assistant Professor.
C.H.W. Jones	B.Sc., Ph.D. (Manchester), Assistant Professor.
E. Kiehlmann	Vordiplom (Tubingen), Ph.D. (Maryland), Assistant Professor.
R.G. Kortelling	A.B. (Hope College), Ph.D. (California), Assistant Professor.
S.K. Lower	B.A. (California), M.S. (Oregon State), Ph.D. (Brit.Col.), Assistant Professor.
G.L. Malli	B.Sc. (Delhi), M.Sc. (McMaster), M.S., Ph.D. (Chicago), Assistant Professor.
Denys Meakin	B.A., M.A. (Oxon), Ph.D. (Alberta) Assistant Professor.

SM 7/8/67

Calendar

A.C. Oehlschlager	B.Sc., Ph.D. (Oklahoma), Assistant Professor.
L.K. Peterson	B.Sc., Ph.D. (Aberdeen), Assistant Professor.
A.G. Sherwood	B.Sc., M.Sc. (Manitoba), Ph.D. (Alberta), Assistant Professor.
K.N. Slessor	B.Sc., Ph.D. (Brit. Col.), Assistant Professor.
Derek Sutton	B.Sc., Ph.D. (Nottingham), Assistant Professor.
E.M. Voigt	B.Sc., M.Sc., (McMaster), Ph.D. (Brit. Col.), Assistant Professor.

Chemistry Program for Non-Chemistry Majors

A 3 semester sequence of Chemistry 102-3, 103-3, 116-2, 117-2, 251-3 and 256-2 or Chemistry 102-3, 103-3, 116-2, 117-2 and 251-3 is recommended. The prerequisites and co-requisites cited below are for students intending to specialise in Chemistry. Certain of these may be waived for non-Chemistry majors with the mutual consent of the Chemistry Department and the Major-Department concerned. Attention is drawn to Chemistry 341-3, a lecture course in Radiochemistry to which non-Chemistry majors (in upper level courses) may be admitted at the discretion of the Chemistry Department.

Chemistry Program for Students intending to specialise in Chemistry

The point at which a student enters into the Chemistry program will be governed by the knowledge of chemistry shown by the student. Chemistry 101-3 and Chemistry 106-2 are not required courses for the B.Sc. degree. Both courses are available as elective courses. Students beginning with no knowledge of Chemistry, or starting from B.C. high school chemistry 11 should take these courses.

All students majoring or taking honors in Chemistry must take the "Core program", together with additional courses as specified below. It is also required that a student take at least 6 Semester hours of Electives in the Faculties of Arts or Education.

SM 7/8/67

Calendar

Core Program (74 Semester hours)

Chemistry: 102-3, 116-2, 102-3, 117-2, 231-3, 251-3, 252-3, 256-2, 261-3, 331-3, 336-2, 341-3, 351-3, 356-2, 361-3, 366-2, 382-3, 367-2.	47 hours
Physics:	15 hours
Mathematics:	15 hours

The Physics and Mathematics should be taken as early in the program as possible so that they will be of benefit in the study of Chemistry.

Chemistry Majors In addition to the core program, students majoring in Chemistry must complete an additional 43 Semester hours of electives. It is required that 10 of these elective hours shall be taken from courses offered by this Department (400 level courses). The remaining 33 Semester hours required may be considered free electives.

Chemistry Honors Students intending to take honors in Chemistry must complete, in addition to the core program, a further 55 semester hours as follows:

Chemistry 481-5, Undergraduate Research	5 hours
Additional senior level courses in Chemistry or related courses as specified by the Department	30 hours
Free Electives	20 hours

Chemistry 481-5 involves the submission of a laboratory or literary thesis making an original contribution to knowledge and prepared under the direction of a member of the Chemistry faculty. Additional graduate course work and a final comprehensive examination may be substituted for the thesis by permission of the Department.

Students intending to pursue advanced study in Chemistry should acquire a reading knowledge of Russian and/or German as early in their program as possible.

Honors in Chemical Physics An honors program in Chemical Physics is offered jointly with the Department of Physics. Entry into this program requires the permission of both departments, and graduates from this program may do graduate work in either Chemistry or Physics. The recommended program revised from that previously listed:-

Levels 1 and 2	Physics 101-3, 102-3 Mathematics 115-3, 116-3 Chemistry 102-3, 116-2, 103-3

Total 28-34 Semester Hours

SM 718167 Calendar

Levels 3 and 4	Physics 221-3, 221-3, 231-3, 232-3 Mathematics 213-3, 214-3, 252-3 Chemistry 231-3, 251-3, 256-2, 261-3, 252-3
	Total: 35 Semester Hours
Levels 5, 6, 7 and 8	Physics 331-3, 351-4, 381-4, 382-4, 451-4, 411-4, 412-4, 421-4, 431-4 Mathematics 481-4, 412-4, 413-4, 422-4 Chemistry 331-3, 361-3, 366-2, 362-3, 336-3, 462-3 **Physics 341-4 or Chemistry 471-3** Instead of any one of Chemistry 366-2, 462-3 Chemistry 481-5 may be substituted.
	Total: 70 or 71 Semester Hours

Biochemistry A major and an honors degree program are offered jointly with the Department of Biological Sciences. Entry into these programs requires the permission of the Biochemistry Committee of the Faculty.

All students taking Biochemistry must complete the "core program", together with additional courses as specified below. Electives are to be chosen in consultation with the Biochemistry Faculty.

Core Program (89 semester hours)

Bioscience 101-4, 102-4, 201-3, 202-3, 305-3, 315-3, 401-3, 402-3, 406-3, 408-3.
Chemistry 102-3, 103-3, 116-2, 117-2, 231-3, 251-3, 252-3, 256-2, 261-3, 356-2, 421-3, 422-3, 426-2, 427-2, 457-3
Mathematics 113-3, 114-3, 213-3, 214-3
Physics 101-3, 102-3

Biochemistry Majors In addition to the core program, students majoring in Biochemistry must complete an additional 31 semester hours of electives, at least 7 hours of which must be in Science.

Biochemistry Honors Students intending to take honors in Biochemistry must complete in addition to the core program, a further 43 semester hours as follows:-

Bioscience 455-3, 431-3
Chemistry 481-5 or Bioscience 498-3 (undergraduate research)
Two courses selected from Chemistry 341-3, 351-3, 361-3
Physics 231-3 and 211-3 or 221-3
Electives 20 or 22 semester hours

SM 7/8/67

Calendar

Presentation of Courses

Fall Semester 1967	Chemistry	101-3, 106-2, 102-3, 116-2, 103-3, 117-2, 251-3, 252-3, 256-2, 261-3, 351-3, 361-3, 366-2, 367-2, 421-3, 426-2, 432-3, 437-2, 442-3, 453-3, 454-3, 457-3, 471-3
Spring Semester 1968	Chemistry	101-3, 106-2, 102-3, 116-2, 103-3, 117-2, 231-3, 251-3, 252-3, 256-2, 261-3, 331-3, 336-2, 341-3, 356-2, 361-3, 362-3, 366-2, 367-2, 422-3, 427-2, 462-3
Summer Semester 1968	Chemistry	101-3, 106-2, 102-3, 116-2, 103-3, 117-2, 231-3, 251-3, 256-2, 261-3, 331-3, 336-2, 361-3, 362-3, 366-2, 367-2, 446-2, 471-3

Chemistry 101-3 General Chemistry I

General fundamental concepts and nomenclature; stoichiometry and chemical calculations; nuclear and atomic structure; the periodic table; the chemical bond; the properties of gases, liquids, solids and solutions; chemical kinetics and chemical equilibrium; reactions and equilibria in solution. (3-1-0)

Prerequisites: No previous training in Chemistry is required for this course. Physics 101-3 and Mathematics 113-3 should ordinarily precede or be taken concurrently. Chemistry 106-2 is ordinarily taken concurrently by students intending to proceed to 200-level courses in Chemistry.

102-3 General Chemistry II

Chemical equilibrium, solubility, acid-base equilibria; Introduction to chemical thermodynamics, the First and Second Laws, Gibbs free energy and equilibrium constants; Properties of ions in solution, galvanic cells and electrochemistry; Rates of reactions, collision theory, absolute rate theory, Nuclear structure, radioactivity, nuclear reactions. (3-1-0)

Prerequisite: B.C. High Schools Chemistry 12 or equivalent, or Chemistry 101-3. Physics 101-3 and Maths 113-3 should ordinarily precede or be taken concurrently. Chemistry 116-2 is ordinarily taken concurrently by students intending to proceed to 200-level Chemistry courses.

SM 7/8/67

Calendar

103-3 Bonding, Structure and Stereochemistry

The structure of atoms and molecules; valence bond and molecular orbital treatment of covalent compounds; the stereochemistry of inorganic and simple organic molecules. (3-1-0)

Prerequisite: Chemistry 102-3. Physics 102-3 should ordinarily precede or be taken concurrently.

106-2 Introductory Laboratory

Experiments in general chemistry which illustrate principles described in Chemistry 101-3. (0-0-4)

Prerequisite: Chemistry 101-3 must ordinarily be taken concurrently.

116-2 General Chemistry Laboratory

Experiments on Chemical Equilibrium. (0-0-4)

Prerequisite: Chemistry 102-3 must ordinarily be taken concurrently.

117-2 Quantitative Chemistry Laboratory

Estimation of chemical compounds by gravimetric, volumetric, electrometric and colorimetric analysis. (0-0-4)

Prerequisite: Chemistry 116-2.

231-3 Inorganic Chemistry I

Crystal stereochemistry; crystal energetics; solubility of ionic crystals; examples of structure involving covalent bonding; symmetry and crystal field theory. (3-1-0)

Prerequisite: Chemistry 103-3.

251-3 Organic Chemistry I

General physical and chemical properties of simple aliphatic and aromatic compounds, including hydrocarbons, alkylhalides, alcohols, ethers, carboxylic acids, aldehydes and ketones. Consideration of free radical and ionic reaction mechanisms; simple spectroscopy. (3-1-0)

Prerequisite: Chemistry 103-3.

SM 7/8/69

Given a ok

252-3 Organic Chemistry II

Discussion of polyfunctional organic compounds and complex organic reactions. (3-1-0)

Prerequisites: Chemistry 251-3. Chemistry 256-2 will ordinarily be taken concurrently.

256-2 Organic Chemistry Laboratory I

Laboratory preparation and characterization of simple organic compounds. (0-0-4)

Prerequisite: Chemistry 251-3. Chemistry 252-3 will normally be taken concurrently.

261-3 Physical Chemistry I

Elements of physical chemistry from the macroscopic point of view applying to the gaseous and liquid state. Thermodynamics, phase changes and equilibria, Chemical equilibrium: Rate processes and concepts in chemical kinetics. (3-1-0)

Prerequisite: Chemistry 102-3 and Math 213-3. It is suggested that Math 214-3 be taken concurrently.

331-3 Inorganic Chemistry II

A systematic treatment of the chemistry of the elements with special reference to the periodic table. The properties of the elements and their binary compounds; the stability of the various oxidation states; a more detailed discussion of the structure, bonding and stereochemistry of those compounds which are of special interest. Methods of purification and separation where these illustrate chemical principles. A simple treatment of ligand field theory will be given in the discussion of the transition elements. (3-1-0)

Prerequisites: Chemistry 231-3. Chemistry 336-2 will ordinarily be taken concurrently.

336-2 Inorganic Chemistry Laboratory I

Preparation of Inorganic compounds selected to illustrate types of bonding and structural principles; determination of physical properties, spectra and magnetic susceptibility. (0-0-4)

Prerequisites: Chemistry 231-3. Chemistry 331-3 will ordinarily be taken concurrently.

SM 7/8/67

Calendar

341-3 Radiochemistry

An introduction to Nuclear Structure, Radioactive Decay, Nuclear Reactions and Interactions of Radiation with matter. The use of Radiation detectors and Instrumentation. Applications of Radioactivity in Chemistry. (3-1-0)

Prerequisite: To be taken following the 200 level program in chemistry.

351-3 Structures and Mechanism in Organic Chemistry

Modern concepts of molecular structure and the mechanisms of organic reactions. (3-1-0)

Prerequisites: Chemistry 252-3. Chemistry 261-3.

356-2 Organic Chemistry Laboratory II

The use of modern techniques for the synthesis of organic compounds. (0-0-4)

Prerequisite: Chemistry 256-2.

361-3 Physical Chemistry II

Kinetic theory; Fundamental principles of quantum mechanics; Introduction to statistical mechanics; Fundamental theories of reaction kinetics; energy transfer, structure of the activated complex. Surface chemistry. (3-1-0)

Prerequisites: Chemistry 261-3. Chemistry 366-3 will ordinarily be taken concurrently. It is strongly recommended that Physics 211-3 shall be taken concurrently.

362-3 Physical Chemistry III

Statistical mechanics - continuation from Chemistry 361-3. Applications of quantum mechanics to atomic and molecular structure. Molecular Spectroscopy. Photochemistry and recent developments in chemical kinetics. Solid state chemistry. (3-1-0)

Prerequisites: Chemistry 361-3. Chemistry 367-2 will ordinarily be taken concurrently.

366-2 Physical Chemistry Laboratory I

Experiments in thermodynamics, chemical kinetics, electrochemistry, and atomic and molecular structure. (0-0-4)

Prerequisite: Chemistry 261. Chemistry 361-3 will ordinarily be taken concurrently.

SM 7/18/67

Calendar

367-2 Physical Chemistry Laboratory II

Continues Chemistry 366-2. (0-0-4)

Prerequisite: Chemistry 366-2. Chemistry 362-3 is ordinarily taken concurrently.

421-3 Descriptive Biochemistry

The chemistry and metabolism of compounds of biochemical importance. (3-1-0)

Prerequisite: Chemistry 232-3. Chemistry 426-2 will ordinarily be taken concurrently.

422-3 Physical Biochemistry

A detailed discussion of certain aspects of biochemistry, on a quantitative basis. Enzyme kinetics, bioenergetics and the behaviour of electrolytes are among the topics to be discussed. (3-1-0)

Prerequisites: Chemistry 252-3. Chemistry 261-3. Chemistry 427 will normally be taken concurrently.

426-2 Biochemistry Laboratory I

An introduction to biochemical laboratory techniques. (0-0-4)

Prerequisites: Chemistry 356-2. Chemistry 421-3 will ordinarily be taken concurrently.

427-2 Biochemistry Laboratory II

A continuation of Chemistry 426-2 involving more specialized techniques. (0-0-4)

Prerequisite: Chemistry 426-2. Chemistry 422-3 will ordinarily be taken concurrently.

SM 718167 Calendar

432-3 Inorganic Chemistry III

Some of the recent developments in inorganic chemistry. The chemistry of lanthanides and actinides, including separation methods. Carbonyls and related compounds. Hydrides, including boron hydrides and electron deficient compounds. Inorganic polymers. The use of non-aqueous solvents in inorganic chemistry.
(3-1-0)

Prerequisite: Chemistry 331-3. Chemistry 437-2 will ordinarily be taken concurrently.

437-2 Inorganic Chemistry Laboratory II

Further preparative studies and physical investigation with special relevance to Chemistry 432-3. Application of vacuum techniques and non-aqueous solvents in Inorganic Chemistry.
(0-0-4)

Co-requisite: Chemistry 432-3.

442-3 Nuclear Chemistry

Detailed study of Nuclear Structures and Systematics. Nuclear Decay Processes. Nuclear Models and Nuclear Reactions.
(3-1-0)

Prerequisites: Chemistry 341-3 Chemistry 361-3.

446-2 Nuclear Chemistry and Radiochemistry Laboratory

Experiments illustrating the principles and uses of nuclear radiation detectors and their associated electronics. Basic studies of the statistics of radioactive decay, measurement of nuclide half-lives, radiation energy measurements, and the analysis of complex gamma-spectra. Neutron activation analysis. The use of radioactive tracers in problems of chemical interest.
(0-0-4)

Prerequisite: Chemistry 341-3 is strongly recommended as a prerequisite.

453-3 Stereochemistry

Stereochemistry of organic molecules with an introduction to conformational analysis. Spectral methods will be discussed and their application to configurational and conformational problems studied.
(3-1-0)

Prerequisite: Chemistry 351-3.

SM 7/18/67

351-3 Advanced Organic Chemistry

A selection of topics such as the non-benzenoid aromatics, heterocyclic chemistry, carbohydrates, terpenes, alkaloids. (3-1-0)

Prerequisite: Chemistry 351-3.

457-3 Modern Laboratory Techniques in Organic Chemistry

Application of chromatography, UV, I-R, N.M.R. and Mass Spectroscopy in the identification and structure determination of organic compounds. (2-0-4)

Prerequisite: Chemistry 356-2.

462-3 Molecular Spectroscopy

Atomic spectra. Electronic, vibrational and rotational spectra of diatomic and polyatomic molecules. The Raman effect. Nuclear and electron spin resonance. Symmetry classification of molecules and their energy levels. (3-1-0)

Prerequisite: Chemistry 362-3.

468-2 Advanced Physical Chemistry Laboratory

Specialized technique in experimental physical chemistry high vacuum techniques, optical spectroscopy, N.M.R, Mass Spectrometry, electronics, glassblowing. (0-0-4)

Prerequisites. Chemistry 362-3 Chemistry 367-2.

471-3 Quantum Chemistry

Advanced application of quantum mechanics to chemical problems. Self consistent field theory. Perturbation theory and the variation method. Group Theory. (3-1-0)

Prerequisite: Chemistry 362-3.

481-5 Undergraduate Research

Laboratory or library research, for preparation of thesis for the honors degree in Chemistry.

Prerequisite. Permission of the Department.