CHEMISTRY (COURSE 5)

5.00[J] Energy Technology and Policy: From Principles to Practice
Same subject as 6.929[J], 10.579[J], 22.813[J]
Prereq: None
Acad Year 2016-2017: Not offered
Acad Year 2017-2018: G (Spring)
3-0-6 units

Develops analytical skills to lead a successful technology implementation with an integrated approach that combines technical, economical and social perspectives. Considers corporate and government viewpoints as well as international aspects, such as nuclear weapons proliferation and global climate issues. Discusses technologies such as oil and gas, nuclear, solar, and energy efficiency. Limited to 100.
J. Deutch

5.03 Principles of Inorganic Chemistry I
Prereq: 5.12
U (Spring)
5-0-7 units

Presents principles of chemical bonding and molecular structure, and their application to the chemistry of representative elements of the periodic system.
A. Radosevich, Y. Surendranath

5.04 Principles of Inorganic Chemistry II
Prereq: 5.03
U (Fall)
4-0-8 units

Systematic presentation of the chemical applications of group theory. Emphasis on the formal development of the subject and its applications to the physical methods of inorganic chemical compounds. Against the backdrop of electronic structure, the electronic, vibrational, and magnetic properties of transition metal complexes are presented and their investigation by the appropriate spectroscopy described.
M. Dinca, Y. Surendranath

5.05 Principles of Inorganic Chemistry III
Prereq: 5.03, *Coreq: 5.04*
G (Fall)
2-0-4 units

Principles of main group (s and p block) element chemistry with an emphasis on synthesis, structure, bonding, and reaction mechanisms.
C. C. Cummins

5.061 Principles of Organometallic Chemistry
Prereq: 5.03
G (Spring; first half of term)
2-0-4 units

A comprehensive treatment of organometallic compounds of the transition metals with emphasis on structure, bonding, synthesis, and mechanism.
R. Schrock

5.062 Principles of Bioinorganic Chemistry
Prereq: 5.03
G (Fall)
3-0-9 units

Delineates principles that form the basis for understanding how metal ions function in biology. Includes the choice, uptake and assembly of metal-containing units; metal-induced folding of biomolecules; control of metal ion concentrations in cells; electron-transfer chemistry; atom and group transfer chemistry; protein tuning of metal properties; and applications to diagnosis and treatment of disease. Introduces additional topics to expose students to exciting new advances in the field, such as medicinal application of inorganic chemistry; multi-component enzyme systems (e.g.,nitrogenase, hydrogenase, and photosystem II); and metalloprotein engineering and design (e.g., the conversion by mutagenesis of existing metalloprotein scaffolds to achieve novel functions).
S. Lippard

5.063 Organometallic Compounds in Catalytic Reactions
Prereq: 5.061
Acad Year 2016-2017: Not offered
Acad Year 2017-2018: G (Spring; first half of term)
2-0-4 units

An exploration of organometallic chemistry from the perspective of catalytic reactions in organic and polymer chemistry.
R. Schrock

5.067 Crystal Structure Refinement
Prereq: 5.068, 5.069, or permission of instructor
G (Fall)
2-3-1 units

Practical aspects of crystal structure determination from data collection strategies to data reduction and basic and advanced refinement problems of organic and inorganic molecules.
P. Mueller

5.068 Physical Inorganic Chemistry
Prereq: 5.03, 5.04
G (Spring; second half of term)
3-0-3 units

Discusses the physical methods used to probe the electronic and geometric structures of inorganic compounds, with additional techniques employed in the characterization of inorganic solids and surfaces. Includes vibrational spectroscopy, solid state and solution magnetochemical methods, Mössbauer spectroscopy, electron paramagnetic resonance spectroscopy, electrochemical methods, and a brief survey of surface techniques. Applications to current research problems in inorganic and solid-state chemistry.
M. Dinca

5.069 Crystal Structure Analysis
Prereq: 5.03, 5.04
G (Spring; first half of term)
2-0-4 units

Introduction to X-ray crystallography: symmetry in real and reciprocal space, space and Laue groups, geometry of diffraction, structure factors, phase problem, direct and Patterson methods, electron density maps, structure refinement, crystal growth, powder methods, limits of diffraction methods, structure data bases.
P. Mueller

5.07[J] Biological Chemistry I
Same subject as 20.507[J]
Prereq: 5.12
U (Fall)
5-0-7 units. REST
Credit cannot also be received for 7.05

Chemical and physical properties of the cell and its building blocks. Structures of proteins and principles of catalysis. The chemistry of organic/inorganic cofactors required for chemical transformations within the cell. Basic principles of metabolism and regulation in pathways, including glycolysis, gluconeogenesis, fatty acid synthesis/degradation, pentose phosphate pathway, Krebs cycle and oxidative phosphorylation, DNA replication, and transcription and translation.
E. Nolan, A. Klibanov

5.08[J] Biological Chemistry II
Same subject as 7.08[J]
Subject meets with 7.80
Prereq: 5.12; 5.07[J] or 7.05
U (Spring)
4-0-8 units

More advanced treatment of biochemical mechanisms that underlie biological processes. Topics include macromolecular machines such as the ribosome, the proteosome, fatty acid synthases as a paradigm for polyketide synthases and non-ribosomal polypeptide synthases, and polymerases. Emphasis is on experimental methods used to unravel these processes and how these processes fit into the cellular context and coordinate regulation.
E. Nolan

5.111 Principles of Chemical Science
Prereq: None
U (Fall, Spring)
5-0-7 units. CHEMISTRY
Credit cannot also be received for 3.091, 5.112, CC.5111, ES.3091, ES.5111, ES.5112

Introduction to chemistry, with emphasis on basic principles of atomic and molecular electronic structure, thermodynamics, acid-base and redox equilibria, chemical kinetics, and catalysis. Introduction to the chemistry of biological, inorganic, and organic molecules.
Fall: M. Shoulders, T. Van Voorhis
Spring: M. Bawendi, M. Hong

5.112 Principles of Chemical Science
Prereq: None
U (Fall)
5-0-7 units. CHEMISTRY
Credit cannot also be received for 3.091, 5.111, CC.5111, ES.3091, ES.5111, ES.5112

Introduction to chemistry for students with an unusually strong background in chemistry. Knowledge of calculus equivalent to 18.01 is recommended. Emphasis on basic principles of atomic and molecular electronic structure, thermodynamics, acid-base and redox equilibria, chemical kinetics, and catalysis. Applications of basic principles to problems in metal coordination chemistry, organic chemistry, and biological chemistry.
R. Schrock, S. Ceyer

5.12 Organic Chemistry I
Prereq: Chemistry (GIR)
U (Fall, Spring)
5-0-7 units. REST
Credit cannot also be received for CC.512

Introduction to organic chemistry. Development of basic principles to understand the structure and reactivity of organic molecules. Emphasis on substitution and elimination reactions and chemistry of the carbonyl group. Introduction to the chemistry of aromatic compounds.
Fall: J. Johnson, P. Ruiz-Castillo
Spring: R. L. Danheiser, P. Ruiz-Castillo

5.13 Organic Chemistry II
Prereq: 5.12
U (Fall)
5-0-7 units

Focuses on synthesis, structure determination, mechanism, and the relationships between structure and reactivity. Selected topics illustrate the role of organic chemistry in biological systems and in the chemical industry.
M. Movassaghi

5.24[J] Archaeological Science
Same subject as 3.985[J], 12.011[J]
Prereq: Chemistry (GIR) or Physics I (GIR)
U (Spring)
3-1-5 units. HASS-S

See description under subject 3.985[J].
H. N. Lechtman

5.301 Chemistry Laboratory Techniques
Prereq: Chemistry (GIR), permission of instructor
U (IAP)
1-4-1 units

Practical training in basic chemistry laboratory techniques. Intended to provide freshmen with the skills necessary to undertake original research projects in chemistry. Freshmen only. Enrollment limited.
J. Dolhun

5.310 Laboratory Chemistry
Prereq: None. *Coreq: 5.12*
U (Fall, Spring)
2-8-2 units. Institute LAB

Introduces experimental chemistry for students who are not majoring in Course 5. Principles and applications of chemical laboratory techniques, including preparation and analysis of chemical materials, measurement of pH, gas and liquid chromatography, visible-ultraviolet spectrophotometry, infrared spectroscopy, kinetics, data analysis, and elementary synthesis. Enrollment limited.
J. Dolhun

5.35 Introduction to Experimental Chemistry
Subject meets with 5.35U
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit.

This 12-unit subject consists of 3 modules, which may be taken during different terms. Modules and prerequisites are as follows:
Module 1 (Prereq: 5.111, 5.112 or 3.091) Survey of spectroscopy.
Module 2 (Prereq: 5.111, 5.112 or 3.091; *Module 1*) Synthesis of coordination compounds and kinetics.
Module 3 (Prereq: 5.111, 5.112 or 3.091; *5.12, Module 2*) Fabrication of a polymeric light emitting device.
Enrollment limited; preference to Course 5 majors.
R. Field (Module 1), Y. Surendranath, M. Twardowski (Module 2), T. Swager (Module 3)

5.35U Introduction to Experimental Chemistry
Subject meets with 5.35
Prereq: See module descriptions under subject 5.35
U (Fall, Spring)
Units arranged
Can be repeated for credit.

For students who might not take all modules of 5.35. Consult department when choosing a version of 5.35. See description for 5.35. May be taken for 8 or 4 units and repeated for credit up to a total of 12 units.
R. W. Field (Module 1), Y. Surendranath, M. Twardowski (Module 2), T. Swager (Module 3)

5.36 Biochemistry and Organic Laboratory
Subject meets with 5.36U
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit.

This 12-unit subject consists of 3 modules, which may be taken during different terms. Instruction and practice in the written and oral presentation of experimental results provided. Modules and prerequisites are as follows:
Module 4 Spring (Prereq: 5.07[J] or 7.05, Module 2 or 5.310, *Module 5*) Expression and Purification of Enzyme Mutants. Must be taken simultaneously with Module 5.
Module 5 Spring (Prereq: 5.07[J] or 7.05, Module 2 or 5.310, *Module 4*) Kinetics of Enzyme Inhibition. Must be taken simultaneously with Module 4.
Module 6 Fall (Prereq: 5.12, Module 2 or 5.310, *5.13*) Organic Structure Determination.
Enrollment limited; preference to Course 5 majors.
Fall: R. L. Danheiser (Module 6)
Spring: B. Pentelute (Modules 4 & 5)

5.36U Biochemistry and Organic Laboratory
Subject meets with 5.36
Prereq: See module descriptions under subject 5.36
U (Fall, Spring)
Units arranged
Can be repeated for credit.

For students who might not take all modules of 5.36. Consult department when choosing a version of 5.36. See description for 5.36. May be taken for 8 or 4 units and repeated for credit up to a total of 12 units.
Fall: R. L. Danheiser (Module 6)
Spring: B. Pentelute (Modules 4 & 5)

5.37 Organic and Inorganic Laboratory
Subject meets with 5.37U
Prereq: See module descriptions
U (Fall, Spring)
Units arranged
Can be repeated for credit.

This 12-unit subject consists of 3 modules, which may be taken during different terms. Modules and prerequisites are as follows:
Module 7 Spring (Prereq: 5.13, Module 6) Continuous Flow Chemistry: Sustainable Conversion of Reclaimed Vegetable Oil into Biodiesel.
Module 8 Fall (Prereq: 5.03, Module 2) Chemistry of Renewable Energy.
Module 9 Fall (Prereq: 5.03, Module 6, *5.61*) Dinitrogen Cleavage.
Enrollment limited; preference to Course 5 majors.
Fall: Y. Surendranath (Module 8); C. C. Cummins (Module 9)
Spring: T. Jamison (Module 7)

5.37U Organic and Inorganic Laboratory
Subject meets with 5.37
Prereq: See module descriptions under subject 5.37
U (Fall, Spring)
Units arranged
Can be repeated for credit.

For students who might not take all modules of 5.37. Consult department when choosing a version of 5.37. See description for 5.37. May be taken for 8 or 4 units and repeated for credit up to a total of 12 units.
Fall: Y. Surendranath (Module 8); C. C. Cummins (Module 9)
Spring: T. Jamison (Module 7)

5.38 Biological and Physical Chemistry Laboratory
Prereq: See module descriptions
U (Spring)
Units arranged
Can be repeated for credit.

This 12-unit subject consists of 3 modules, which may be taken during different terms. Instruction and practice in the written and oral presentation of experimental results provided. Modules and prerequisites are as follows:
Module 10 (Prereq: 5.61, Module 6) Quantum Dots.
Module 11 (Prereq: 5.61, 5.07[J] or 7.05, Module 5) Time Resolved Molecular Spectroscopy.
Module 12 (Prereq: 5.07[J] or 7.05, Module 6)Fast Flow Peptide and Protein Synthesis.
Enrollment limited; preference to Course 5 majors.
M. G. Bawendi (Module 10), G. Schlau-Cohen (Module 11), B. Pentelute (Module 12)

5.43 Advanced Organic Chemistry
Prereq: 5.13
U (Fall)
4-0-8 units
Credit cannot also be received for 5.53

Reaction mechanisms in organic chemistry: methods of investigation, relation of structure to reactivity, and reactive intermediates. Photochemistry and organometallic chemistry, with an emphasis on fundamental reactivity, mechanistic studies, and applications in organic chemistry.
T. Swager

5.44 Organometallic Chemistry
Prereq: 5.43, 5.47, 5.061, or permission of instructor
G (Spring; first half of term)
Not offered regularly; consult department
2-0-4 units

Examination of the most important transformations of organotransition-metal species. Emphasizes basic mechanisms of their reactions, structure-reactivity relationships, and applications in synthesis.
Staff

5.45 Heterocyclic Chemistry
Prereq: 5.511, 5.53
G (Spring; first half of term)
2-0-4 units

Provides an introduction to the chemistry of heterocyclic compounds. Surveys synthesis and reactivity of the major classes of heterocyclic organic compounds. Discusses the importance of these molecules in the pharmaceutical and other industries.
S. Buchwald

5.46 NMR Spectroscopy and Organic Structure Determination
Prereq: 5.43
G (Spring; first half of term)
2-0-4 units

Applications of 1-D and 2-D ^{1}H and ^{13}C NMR spectroscopy to organic structure determination.
J. H. Simpson

5.47 Tutorial in Organic Chemistry
Prereq: 5.43, permission of instructor
G (Fall; partial term)
2-0-4 units

Systematic review of basic principles concerned with the structure and transformations of organic molecules. Problem-solving workshop format. The program is intended primarily for first-year graduate students with a strong interest in organic chemistry. Meets during the month of September.
R. L. Danheiser

5.511 Synthetic Organic Chemistry I
Prereq: 5.43
G (Fall; partial term)
3-0-9 units

Introduction to the design of syntheses of complex organic compounds.
R. L. Danheiser

5.512 Synthetic Organic Chemistry II
Prereq: 5.511
G (Spring; second half of term)
Not offered regularly; consult department
2-0-4 units

General methods and strategies for the synthesis of complex organic compounds.
Staff

5.52 Advanced Biological Chemistry
Prereq: Permission of instructor
G (Fall)
2-2-8 units

Concepts and methods of biochemistry, with emphasis on quantitative aspects of problem analysis and fundamentals of experimental methods. Intended for first-year graduate students with a strong interest in biological chemistry.
A. M. Klibanov

5.53 Molecular Structure and Reactivity
Prereq: 5.13, 5.60
G (Fall; partial term)
3-0-6 units
Credit cannot also be received for 5.43

Reaction mechanisms in organic chemistry: methods of investigation, relation of structure to reactivity, and reactive intermediates.
J. Van Humbeck

5.54[J] Frontiers in Chemical Biology
Same subject as 7.540[J], 20.554[J]
Prereq: 5.13, 5.07[J], 7.06, permission of instructor
G (Fall)
2-0-4 units

Introduction to current research at the interface of chemistry, biology, and bioengineering. Topics include imaging of biological processes, metabolic pathway engineering, protein engineering, mechanisms of DNA damage, RNA structure and function, macromolecular machines, protein misfolding and disease, metabolomics, and methods for analyzing signaling network dynamics. Lectures are interspersed with class discussions and student presentations based on current literature.
M. Shoulders

5.56 Molecular Structure and Reactivity II
Prereq: Permission of Instructor
Acad Year 2016-2017: G (Spring; second half of term)
Acad Year 2017-2018: Not offered
2-0-4 units

Application of physical principles and methods to contemporary problems of interest in organic chemistry.
J. Johnson

5.561 Chemistry in Industry
Prereq: 5.03; 5.07[J] or 7.05; 5.13
G (Spring; second half of term)
2-0-4 units

Examination of recent advances in organic, biological, and inorganic and physical chemical research in industry. Taught in seminar format with participation by scientists from industrial research laboratories.
R. L. Danheiser

5.60 Thermodynamics and Kinetics
Prereq: Calculus II (GIR), Chemistry (GIR)
U (Fall, Spring)
5-0-7 units. REST

Equilibrium properties of macroscopic systems. Basic thermodynamics: state of a system, state variables. Work, heat, first law of thermodynamics, thermochemistry. Second and third law of thermodynamics: entropy and free energy, including the molecular basis for these thermodynamic functions. Phase equilibrium and properties of solutions. Chemical equilibrium of reactions in gas and solution phases. Rates of chemical reactions. Special attention to thermodynamics related to global energy issues.
Fall: M. Bawendi, A. Shalek
Spring: R. Field, A. Willard

5.61 Physical Chemistry
Prereq: Physics II (GIR), Calculus II (GIR), Chemistry (GIR)
U (Fall)
5-0-7 units. REST

Introductory quantum chemistry; particles and waves; wave mechanics; atomic structure and the Periodic Table; valence and molecular orbital theory; molecular structure; and photochemistry.
R. Field, M. Hong

5.62 Physical Chemistry
Prereq: 5.60, 5.61
U (Spring)
4-0-8 units

Elementary statistical mechanics; transport properties; kinetic theory; solid state; reaction rate theory; and chemical reaction dynamics.
S. Ceyer, J. Cao

5.64[J] Frontiers of Interdisciplinary Science in Human Health and Disease
Same subject as HST.539[J]
Prereq: 5.13, 5.60; 5.07[J] or 7.05
G (Spring)
3-0-9 units

Introduces major principles, concepts, and clinical applications of biophysics, biophysical chemistry, and systems biology. Emphasizes biological macromolecular interactions, biochemical reaction dynamics, and genomics. Discusses current technological frontiers and areas of active research at the interface of basic and clinical science. Provides integrated, interdisciplinary training and core experimental and computational methods in molecular biochemistry and genomics.
A. Shalek

5.68[J] Kinetics of Chemical Reactions
Same subject as 10.652[J]
Prereq: 5.62, 10.37, or 10.65
Acad Year 2016-2017: G (Fall)
Acad Year 2017-2018: Not offered
3-0-6 units

Experimental and theoretical aspects of chemical reaction kinetics, including transition-state theories, molecular beam scattering, classical techniques, quantum and statistical mechanical estimation of rate constants, pressure-dependence and chemical activation, modeling complex reacting mixtures, and uncertainty/ sensitivity analyses. Reactions in the gas phase, liquid phase, and on surfaces are discussed with examples drawn from atmospheric, combustion, industrial, catalytic, and biological chemistry.
W. H. Green

5.697[J] Quantum Chemical Simulation
Same subject as 10.437[J]
Subject meets with 5.698[J], 10.637[J]
Prereq: None
U (Fall)
3-0-9 units

See description under subject 10.437[J].
H. J. Kulik

5.698[J] Quantum Chemical Simulation
Same subject as 10.637[J]
Subject meets with 5.697[J], 10.437[J]
Prereq: None
G (Fall)
3-0-9 units

See description under subject 10.637[J].
H. J. Kulik

5.70[J] Statistical Thermodynamics
Same subject as 10.546[J]
Prereq: 5.60 or permission of instructor
G (Fall)
3-0-9 units

Develops classical equilibrium statistical mechanical concepts for application to chemical physics problems. Basic concepts of ensemble theory formulated on the basis of thermodynamic fluctuations. Examples of applications include Ising models, lattice models of binding, ionic and non-ionic solutions, liquid theory, polymer and protein conformations, phase transition, and pattern formation. Introduces computational techniques with examples of liquid and polymer simulations.
A. Willard, B. Zhang

5.72 Statistical Mechanics
Prereq: 5.70[J], 5.73, 18.075
Acad Year 2016-2017: G (Spring; second half of term)
Acad Year 2017-2018: Not offered
2-0-4 units

Principles and methods of statistical mechanics. Classical and quantum statistics, grand ensembles, fluctuations, molecular distribution functions, and other topics in equilibrium statistical mechanics. Topics in thermodynamics and statistical mechanics of irreversible processes.
J. Cao

5.73 Introductory Quantum Mechanics I
Prereq: 5.61, 8.03, 18.03
G (Fall)
3-0-9 units

Presents the fundamental concepts of quantum mechanics: wave properties, uncertainty principles, Schrodinger equation, and operator and matrix methods. Includes applications to one-dimensional potentials (harmonic oscillator), three-dimensional centrosymetric potentials (hydrogen atom), and angular momentum and spin. Approximation methods include WKB, variational principle, and perturbation theory.
R. G. Griffin

5.74 Introductory Quantum Mechanics II
Prereq: 5.73
G (Spring)
3-0-9 units

Time-dependent quantum mechanics and spectroscopy. Topics include perturbation theory, two-level systems, light-matter interactions, relaxation in quantum systems, correlation functions and linear response theory, and nonlinear spectroscopy.
K. Nelson, G. Schlau-Cohen

5.78 Biophysical Chemistry Techniques
Subject meets with 7.71
Prereq: 5.07[J] or 7.05
Acad Year 2016-2017: G (Spring; first half of term)
Acad Year 2017-2018: Not offered
2-0-4 units

Presents principles of macromolecular crystallography that are essential for structure determinations. Topics include crystallization, diffraction theory, symmetry and space groups, data collection, phase determination methods, model building, and refinement. Discussion of crystallography theory complemented with exercises such as crystallization, data processing, and model building. Meets with 7.71 when offered concurrently. Enrollment limited.
C. Drennan, T. Schwartz

5.80 Advanced Topics of Current Special Interest
Prereq: 5.61 or 8.04; 18.03
G (Fall, Spring)
3-0-9 units

Advanced topics of current special interest.
Staff

5.891 Independent Study in Chemistry for Undergraduates
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

undefined

5.892 Independent Study in Chemistry for Undergraduates
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Program of independent study under direction of Chemistry faculty member. May not substitute for required courses for the Chemistry major or minor.
Staff

5.90 Problems in Chemistry
Prereq: Permission of instructor
G (Fall, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Directed research and study of special chemical problems. For Chemistry graduate students only.
R. W. Field

5.913 Seminar in Organic Chemistry
Prereq: Permission of instructor
G (Fall, Spring)
2-0-1 units
Can be repeated for credit.

Discusses current journal publications in organic chemistry by graduate students and staff members.
R. L. Danheiser

5.921 Seminar in Biological Chemistry
Prereq: Permission of instructor
G (Fall, Spring)
2-0-1 units
Can be repeated for credit.

Discusses topics of current interest in biological chemistry by graduate students and staff.
M. Shoulders

5.931 Seminar in Physical Chemistry
Prereq: 5.60
G (Fall, Spring)
2-0-1 units
Can be repeated for credit.

Discusses topics of current interest in physical chemistry by staff members and students.
A. Willard

5.941 Seminar in Inorganic Chemistry
Prereq: 5.03
G (Fall, Spring)
2-0-1 units
Can be repeated for credit.

Discusses current research in inorganic chemistry by graduate students and staff.
S. Lippard

5.95[J] Teaching College-Level Science and Engineering
Same subject as 1.95[J], 7.59[J], 8.395[J], 18.094[J]
Subject meets with 2.978
Prereq: None
G (Fall)
2-0-2 units

Participatory seminar focuses on the knowledge and skills necessary for teaching science and engineering in higher education. Topics include theories of adult learning; course development; promoting active learning, problemsolving, and critical thinking in students; communicating with a diverse student body; using educational technology to further learning; lecturing; creating effective tests and assignments; and assessment and evaluation. Students research and present a relevant topic of particular interest. Appropriate for both novices and those with teaching experience.
J. Rankin

5.THG Graduate Thesis
Prereq: Permission of instructor
G (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Program of research leading to the writing of a PhD thesis; to be arranged by the student and an appropriate MIT faculty member.
R. W. Field

5.THU Undergraduate Thesis
Prereq: Permission of instructor
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Program of original research under supervision of a chemistry faculty member, culminating with the preparation of a thesis. Ordinarily requires equivalent of two terms of research with chemistry department faculty member.
Staff

5.UR Undergraduate Research
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged [P/D/F]
Can be repeated for credit.

Program of research to be arranged by the student and a departmental faculty member. Research can be applied toward undergraduate thesis.
C. C. Cummins

5.URG Undergraduate Research
Prereq: None
U (Fall, IAP, Spring, Summer)
Units arranged
Can be repeated for credit.

Program of research to be arranged by the student and a departmental faculty member. May be taken for up to 12 units per term, not to exceed a cumulative total of 48 units. A 10-page paper summarizing research is required.
C. C. Cummins