I. Approval of CUSA Minutes from February 14, 2012

II. Chair’s Report

III. Dean’s Office Report

IV. CLA&S Student Academic Services Report

V. Subcommittee Chair Reports
   A. Advising & Awards
      1. College Scholarships Update
   B. Curricular Changes/Degree Requirements
      1. Curricular Changes for Approval:
         NEW COURSES: HWC 490, ISP 490
         CHANGES: GINS 101, HWC 335, ISP 335, TD 301-TD 401, TD 302-TD402, TD 303-TD 405
         DELETIONS:
         Curricular Changes Motion to File: NONE
      2. Degree Requirements for Approval:
         a. New Non-Western Culture Designation for EALC 121
         b. Changes to Chemistry Major and Minor
         c. Chemistry Related Changes to other Majors and Minors
         d. Proposal for a change to criteria for selecting the BGS LA&S option

VI. Old Business
   a. Discussion of degree specific general education requirements in the College, especially as they relate to the first three goals (FYU University goal is 36 hours or fewer required at University level)

VII. C. Academic Standards Report

VI. New Business
COMMITTEE ON UNDERGRADUATE STUDIES AND ADVISING
Minutes of the Meeting for February 14, 2012

The committee met on Tuesday, February 14, 2012, at 11:00 a.m. in Room 210 Strong Hall. The following were present: Bradley, Burright, Childers, Conrad, Corbeill, Crosby, DeBoer, Fischer, Goldstein, Gray, Jackson, Jelks, Ledom, Neidert, Pye, Vanchena
Hulse (guest)

MINUTES A motion was made to approve the January 24, 2012 minutes.

CHAIR'S REPORT The foreign language surveys were completed and sent out. For the first survey, the foreign language departments were asked to give feedback we could use to establish an outcomes based discussion or rational for a foreign language requirements. In the second survey departments were asked to tell their thoughts in very general language about foreign languages role in their view. We also asked for their input and information about foreign language as a BS. The departments were given a two week deadline. Professor Fischer cautioned that we need to be very careful about crafting the language for a foreign language requirement. If the language is too vague it could allow more people to find ways to get around the requirements. Professor Fischer asked what is unique to foreign language study that cannot be satisfied another way. There may be an opportunity for discussions of overlapping with math or computer programming as different ways of expressing different thoughts and ideas

Professor Fischer received a summary from the math department for the outcomes for the College algebra course. Ms. Bradley provided statistical data regarding math. Out of our freshman class last fall, 22.6% of the freshmen needed to take math 002; 33.5% needed to take math 101 and 43.9% were okay. Of that 43.9%, 16.1% had both levels of math completed.

For students that are sophomores and above, 6.9% need math 002; 11.5% needed math 101 and 81.6% were okay. Out of that 81.6%, 49.2% had both completed. (This takes into account all students in the college and school of the arts and it also takes into account that anyone pursuing a BFA that does not need math.)

It was felt that we need to build into the requirements that students need to come to KU ready to begin with math 101 as the lowest level math course if we want to meet our goal of students graduating in four years.

Ms. Bradley will try to find data relating to the students coming in needing math 002 making it through to their degree program. Also if they complete it in sequence or if they need to retake math 002 several times before moving on to math 101 and how it affects their graduation.

DEAN’S OFFICE REPORT Associate Dean Goldstein reported that he met with Chris Haufler with regarding the KUCore. They are making progress and moving along quickly. The KUCore should be released shortly, giving this committee more definitive perimeters to go by. Chris Haufler will be invited to this committee meeting in March for ongoing communication and to discuss this committee’s questions and responses to KUCore requirements.

Associate Dean Goldstein felt that the committee needs to continue to map out courses that go beyond the core requirements but be mindful of the number of courses we recommend. Our goal is to keep the number of requirements below the number of the previous requirements.

To satisfy the requirements for the goals at the university level, departments may only need to make slight adjustments to their syllabus. Documentation will need to be submitted dealing with satisfaction of outcome assessment for each of them. CUSA will vet courses that are submitted first; this should happen next fall. This committee may need to look at forming an ad-hoc committee or a sub-committee that looks at the copy of syllabi and looks at outcome assessments that are submitted. Once CUSA vets the requests for the College they will then go on to the university level.

CLA&S STUDENT ACADEMIC SERVICES REPORT No report at this time.

SUBCOMMITTEE CHAIR REPORTS
A. ADVISING & AWARDS
Report on meeting with Kristi Henderson from the Dean’s Office regarding College Scholarships. It was reported that we had between eight and 10 scholarship awards and now it is down to three or maybe two. For future awards they are contemplating requiring a topical essay.

B. CURRICULAR CHANGES/DEGREE REQUIREMENTS
Professor Conrad presented the following:

1. Curricular Changes for Approval

NEW COURSES APPROVED: EALC 121, KOR 562, KOR 564, LING 451
NEW COURSES TABLED: EALC 564
CHANGES APPROVED: BIOL 661, CHIN 106, ITAL 107, ITAL 108, ITAL 110, ITAL 120, ITAL 155, ITAL 156, ITAL 230, ITAL 240, ITAL 300, ITAL 315, VAE 497, VAE 500

CHANGED TABLED:

DELETIONS APPROVED: BIOL 660

Chemistry Course Changes for Approval:

NEW COURSES APPROVED CHEM, 170, CHEM 175


2. Degree Requirements for Approval

APPROVED: Change to Existing BA in Geology-Environmental Geology option (related to BIOL 660/661 change)

C. ACADEMIC STANDARDS

No report at this time.

NEW BUSINESS Standing discussion of general education requirements.

The meeting was adjourned at 12:18 p.m.
A. Advising & Awards

1. **Paul B. Lawson Award**
The award recipients are selected based on their record through their junior year.

**Hilden Gibson Award**
The award recipients are selected based on their record through their junior or senior years. Recipients must also be studying in the social sciences.

**Betty Wahlstedt Student Memorial**
The award recipients must be studying Psychology, Sociology or Anthropology. Student can be at any undergraduate level.

**Veta B. Lear Award**
This award is to be given to freshmen who earned a 4.0 in their first semester. It is awarded as a credit to the KU Bookstore.

**Van Eekeren Family Scholarship**
Undergraduates with GPA between 2.5 and 3.2 and no withdraws.

B. Curricular Changes/Degree Requirements

1. Curricular Changes for Approval/Motion to File

**HUMANITIES AND WESTERN CIVILIZATION**

CHANGE: NEW CROSS-LISTED COURSE
HWC 335 INTRODUCTION TO INDIGENOUS STUDIES 03 H, NW
This course is an introduction to the study of modern and historic indigenous peoples. It surveys the concepts, methods and content relevant to Indigenous Studies, using case studies drawn from the diverse indigenous cultures. Special attention is paid to the various ways in which standard academic disciplines -- history, anthropology, literature, law, political science, among others -- contribute to the study of indigenous cultures and current issues. The course illustrates that the social, political, religious, and economic aspects of "American Indian" life are interconnected and tribal histories and cultures cannot be understood without an awareness of these fields. (Same as ISP 335) LEC

NEW COURSE: NEW CROSS-LISTED COURSE
HWC 490 ROOTS OF FEDERAL INDIAN POLICY 03
This course introduces students to the basic concepts and ideologies of US Federal Indian policy. It surveys European intellectual trends that were influential in creating policies applied to colonized native peoples. The course explores the origins of such policies, including removals, "civilization programs," the reservation period, the Dawes (Alotment) Act, the New deal, termination, relocation, NAGPRA and tribal rights, in addition to issues surrounding American Indian identity, tribal membership and demographics. This course serves as a foundation for more in-depth study of Federal Indian Law pertinent to the Indigenous peoples of the United States. (Same as ISP 490) LEC

**INDIGENOUS STUDIES PROGRAM**

CHANGE: COURSE DESCRIPTION NUMBER PREFIX
GINS 101 INTRODUCTION TO INDIGENOUS STUDIES 3 H, NW
An introduction to the study of Indigenous peoples. It surveys the concepts, methods and content relevant to Applied Indigenous Studies, using case studies drawn from diverse cultures. The course illustrates that the social, political, religious, and economic aspects of American Indian life are interconnected and that tribal histories cannot be understood without an awareness of these fields. Students are introduced to controversies over how to research, write and interpret American Indians, and
will address the foundations of Indigenous Studies, and that is Indigenous concepts of decolonization, empowerment and Nation-building. The course explores how the lives of Indigenous people have been affected by colonization, while exploring the varying definitions of "colonialism", "colonizer" and the "colonized."

CHANGE: COURSE DESCRIPTION NUMBER PREFIX
ISP 335 INTRODUCTION TO INDIGENOUS STUDIES 3 H, NW
This course is an introduction to the study of modern and historic indigenous peoples. It surveys the concepts, methods, and content relevant to Indigenous Studies, using case studies drawn from the diverse indigenous cultures. Special attention is paid to the various ways in which standard academic disciplines--history, anthropology, literature, law, political science, among others--contribute to the study of Indigenous cultures and current issues. The course illustrates that the social, political, religious, and economic aspects of "American Indian" life are interconnected and tribal histories and cultures cannot be understood without an awareness of these fields. (Same as HWC 335) LEC.

NEW COURSE: NEW CROSS-LISTED COURSE
ISP 490 ROOTS OF FEDERAL INDIAN POLICY 03
This course introduces students to the basic concepts and ideologies surrounding modern United States Federal Indian policy. It will survey the European intellectual trends that were influential in creating policies that were (and still are) applied to the colonized Native peoples. The course will explore the roots of US Indian policy, including removals, "civilization programs," the reservation period, the Dawes (Allotment) Act, the New Deal, termination, relocation, NAGPRA and tribal rights, in addition to the issues surrounding American Indian identity, tribal membership and demographics. This course serves as the foundation for more in-depth study into the complicated and ever-changing field of Federal Indian Law as it pertains to the Indigenous peoples of the United States. (Same as ISP 490) LEC.

VISUAL ART

CHANGE: NUMBER
TD 301 WEAVE STRUCTURES 3 U
(OLD) Continuation of TD 314. Research and analysis of multiple-harness weave structures. Weave drafts. Design problems to develop the use of color, form, and surface in simple and compound weaves. Prerequisite: TD 314. LAB

TD 401 WEAVE STRUCTURES 3 U
(NEW) Continuation of TD 314. Research and analysis of multiple-harness weave structures. Weave drafts. Design problems to develop the use of color, form, and surface in simple and compound weaves. Prerequisite: TD 314. LAB

CHANGE: NUMBER
TD 302 TECHNIQUES IN WEAVING 3 U
(OLD) Development of individual art and design concepts in relation to woven structures and/or forms. Emphasis on weaver-controlled techniques used to create images and composition. Prerequisite: TD 314. LAB

TD 402 TECHNIQUES IN WEAVING 3 U
(NEW) Development of individual art and design concepts in relation to woven structures and/or forms. Emphasis on weaver-controlled techniques used to create images and composition. Prerequisite: TD 314. LAB

CHANGE: NUMBER
TD 303 EXPERIMENTAL CONCEPTS IN WEAVING 3 U
(OLD) Experimentation with resist dyeing, painted warps and/or "Fiber Forms" techniques in woven structures. Individual research and development of thematic concepts. Prerequisite: TD 313, and TD 301 or TD 302. LAB

TD 405 EXPERIMENTAL CONCEPTS IN WEAVING 3 U
(NEW) Experimentation with resist dyeing, painted warps and/or "Fiber Forms" techniques in woven structures. Individual research and development of thematic concepts. Prerequisite: TD 313, and TD 301 or TD 302. LAB
2. Degree Requirements for Approval

a. New Non-Western Culture Designation
   Course Number and Title: EALC 121 Introduction to Contemporary China
   Course description: An overview of contemporary Chinese culture and society since the economic reforms and opening up launched in 1978, through the study of changes in politics, the economy, society, culture and everyday life in China. The course is taught in English. NO prior knowledge of the Chinese language is required. NW

b. Changes to Chemistry
   Chemistry Major and Minor Changes
   Requirements for the B.A. Major (Current)

   In addition to the common College requirements for the B.A., a minimum of 29 to 30 hours in chemistry (including 5 hours each of analytical, organic, and physical chemistry lecture and laboratory) and one year each of calculus and physics (prerequisites for physical chemistry) are required. These courses fulfill the requirements:

   **Chemistry Courses** 29 hours

   CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)
   CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)
   CHEM 295 Seminar I (0.5)
   CHEM 622 Fundamentals of Organic Chemistry (3) or
   CHEM 624 (or CHEM 628) Organic Chemistry I (3)
   CHEM 625 Organic Chemistry I Laboratory (2)
   CHEM 516 Analytical Chemistry (3)
   CHEM 517 Analytical Chemistry Laboratory (2)
   CHEM 640 Biological Physical Chemistry (3) and
   CHEM 641 Biological Physical Chemistry Laboratory (2) or
   CHEM 646 Physical Chemistry I (3) and
   CHEM 647 Physical Chemistry I Laboratory (2)
   CHEM 695 Seminar II (0.5)
   Additional chemistry course (3)

   **Mathematics and Physics** 14-18 hours

   MATH 115 Calculus I (3) or
   MATH 121 Calculus I (5)
   MATH 116 Calculus II (3) or
   MATH 122 Calculus II (5)

   PHSX 114 College Physics I (4) or
   PHSX 211 General Physics I (4)
   PHSX 115 College Physics II (4) or
   PHSX 212 General Physics II (4)

   Courses that fulfill the additional 3 hours for the major are CHEM 626 (or CHEM 630) Organic Chemistry II, CHEM 635 and CHEM 636 Instrumental Methods of Analysis and Laboratory, CHEM 648 Physical Chemistry II, or CHEM 667 Systematic Inorganic Chemistry. Note that CHEM 648 has CHEM 646, **MATH 223**, and MATH 290 as prerequisites. Students in premedical programs should be aware that a year of organic chemistry lecture and laboratory (CHEM 624 or CHEM 628, CHEM 625, CHEM 626 or CHEM 630, and CHEM 627) is required for admission to virtually all medical schools. Students who need only 1 semester of organic chemistry should substitute CHEM 622 (the 1-semester organic chemistry lecture course) for CHEM 624, when possible.
Requirements for the B.A. Major (New)

In addition to the common College requirements for the B.A., a minimum of 29 to 30 hours in chemistry (including 5 hours each of analytical, organic, and physical chemistry lecture and laboratory) and one year each of calculus and physics (prerequisites for physical chemistry) are required. These courses fulfill the requirements:

Chemistry Courses  29 hours

CHEM 170 Chemistry for the Chemical Sciences I (5) or
CHEM 130 General Chemistry I (5) or
CHEM 190 Foundations of Chemistry I, Honors (5)
CHEM 175 Chemistry for the Chemical Sciences II (5) or
CHEM 135 General Chemistry II (5) or
CHEM 195 Foundations of Chemistry II, Honors (5)
CHEM 295 Seminar I (0.5)
CHEM 210 Fundamentals of Organic Chemistry (3) or
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I, Honors (3)
CHEM 231 Organic Chemistry I Laboratory (2)
CHEM 510 Biological Physical Chemistry (3) and
CHEM 511 Biological Physical Chemistry Laboratory (2) or
CHEM 530 Physical Chemistry I (3) and
CHEM 531 Physical Chemistry I Laboratory (2)
CHEM 620 Analytical Chemistry (3)
CHEM 621 Analytical Chemistry Laboratory (2)
CHEM 695 Seminar II (0.5)

Additional chemistry course (3 or 4)

Mathematics and Physics  14-18 hours

MATH 115 Calculus I (3) or
MATH 121 Calculus I (5)
MATH 116 Calculus II (3) or
MATH 122 Calculus II (5)

PHSX 114 College Physics I (4) or
PHSX 211 General Physics I (4)
PHSX 115 College Physics II (4) or
PHSX 212 General Physics II (4)

Courses that fulfill the additional 3 hours for the major are CHEM 235 (or CHEM 285) Organic Chemistry II, CHEM 635 and CHEM 636 Instrumental Methods of Analysis and Laboratory, CHEM 535 Physical Chemistry II, or CHEM 660 Systematic Inorganic Chemistry. Note that CHEM 535 has CHEM 530 and MATH 290 as prerequisites. Students in premedical programs should be aware that a year of organic chemistry lecture and laboratory (CHEM 230 or 280, CHEM 231, CHEM 235 or 285, and CHEM 236) is required for admission to virtually all medical schools. Students who need only 1 semester of organic chemistry should substitute CHEM 210 (the 1-semester organic chemistry lecture course) for CHEM 230 when possible.

Justification:

1) Change in titles for courses formerly numbered CHEM 184 and 188 (new numbers CHEM 130 and 135, respectively)
2) Addition of a proposed new two course freshman chemistry sequence, CHEM 170 and 175.
a. Correction to a clerical error in the bottom section listing the courses that fulfill the additional 3 hours for the major: MATH 223 is no longer a prerequisite for CHEM 535.

B.A. Major: Biological Chemistry Option (Current)

This option is available to students interested in the biological applications of chemistry. The curriculum is compatible with many pre-health-professions programs and prepares the student for graduate study or career opportunities.

In addition to all of the requirements for the regular B.A. major, the following courses are required:

*CHEM 626 (or CHEM 630) Organic Chemistry II (3)
CHEM 627 Organic Chemistry II Laboratory (2)
BIOL 636 Biochemistry I (3)
BIOL 638 Biochemistry II (3)

Plus 1 elective (3) (In consultation with a faculty major adviser, choose 1 course from those listed in the Biology Option Group in Requirements for the B.S. Degree in Chemistry: Biological Chemistry Option.)

*Select this course as the additional chemistry course.

B.A. Major: Biological Chemistry Option (New)

This option is available to students interested in the biological applications of chemistry. The curriculum is compatible with many pre-health-professions programs and prepares the student for graduate study or career opportunities.

In addition to all of the requirements for the regular B.A. major, the following courses are required:

*CHEM 235 (or CHEM 285) Organic Chemistry II (3)
CHEM 236 Organic Chemistry II Laboratory (2)
BIOL 636 Biochemistry I (3)
BIOL 638 Biochemistry II (3)

Plus 1 elective (3) (In consultation with a faculty major adviser, choose 1 course from those listed in the Biology Option Group in Requirements for the B.S. Degree in Chemistry: Biological Chemistry Option.)

*Select this course as the additional chemistry course.

Justification:

1) Renumbering of the courses

B.A. Major: Environmental Chemistry Option (Current)

This option is available to students who plan to use their chemistry background in environmentally related areas. The additional courses required provide background in other environmental sciences as well as further exposure to important methods used in environmental laboratories.

In addition to all of the requirements for the regular B.A. major, the following courses are required:
*CHEM 626 (or CHEM 630) Organic Chemistry II (3)
CHEM 627 Organic Chemistry II Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)

Plus 2 electives (6) (In consultation with a faculty major adviser, choose two courses from those listed in Environmental Chemistry Option Group I or Environmental Chemistry Option Group II below.)

**Environmental Chemistry Option Group I**

BIOL 100 Principles of Biology (3) **or**
BIOL 150 Principles of Molecular and Cellular Biology (4)
EVRN 148 Scientific Principles of Environmental Studies (3)
GEOG 304 Environmental Conservation (3)
GEOL 351 Environmental Geology (3)
BIOL 400 Fundamentals of Microbiology (3)
BIOL 414 Principles of Ecology (3)
BIOL 600 Introductory Biochemistry, Lectures (4)
ATMO 105 Introductory Meteorology (5)

**Environmental Chemistry Option Group II**

BIOL 660 Lake Ecology (with or without BIOL 662) Aquatic Ecology Laboratory (3-5)
CE 477 Introduction to Environmental Engineering and Science (3)
GEOL 552 Introduction to Hydrogeology (3)
ATMO 525 Air Pollution Meteorology (3)
EVRN 611 Water Quality, Land Use, and Watershed Ecosystems (3)
CHEM 698 Undergraduate Research Problems (3)
*Select this course as the additional chemistry course.

**B.A. Major: Environmental Chemistry Option (New)**

This option is available to students who plan to use their chemistry background in environmentally related areas. The additional courses required provide background in other environmental sciences as well as further exposure to important methods used in environmental laboratories.

In addition to all of the requirements for the regular B.A. major, the following courses are required:

*CHEM 235 (or CHEM 285) Organic Chemistry II (3)
CHEM 236 Organic Chemistry II Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)

Plus 2 electives (6) (In consultation with a faculty major adviser, choose two courses from those listed in Environmental Chemistry Option Group below)

**Environmental Chemistry Option Group**

BIOL 100 Principles of Biology (3) **or**
BIOL 150 Principles of Molecular and Cellular Biology (4)
EVRN 148 Scientific Principles of Environmental Studies (3)
GEOG 304 Environmental Conservation (3)
GEOL 351 Environmental Geology (3)  
BIOL 400 Fundamentals of Microbiology (3)  
BIOL 414 Principles of Ecology (3)  
BIOL 600 Introductory Biochemistry, Lectures (4)  
ATMO 105 Introductory Meteorology (5)  
BIOL 660 Lake Ecology  
661 Ecology of Rivers and Lakes (with or without BIOL 662)  
Aquatic Ecology Laboratory) (3-5)  
CE 477 Introduction to Environmental Engineering and Science (3)  
GEOL 552 Introduction to Hydrogeology (3)  
ATMO 525 Air Pollution Meteorology (3)  
EVRN 611 Water Quality, Land Use, and Watershed Ecosystems (3)  
CHEM 698 Undergraduate Research Problems (3)  
*Select this course as the additional chemistry course.

**Justification:**

1) Renumbering of the courses.
2) Clarifying the number of Option I and Option II courses that are required.

**Requirements for the B.S. Degree (Current)**

The significant differences between the B.S. and B.A. lie in the distribution requirements and the required subjects. This outline lists all required courses and some suggested electives. The program satisfies College requirements as well as certification standards of the American Chemical Society.

**Chemistry Courses** 50 hours

CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)  
CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)  
CHEM 295 Seminar I (0.5)  
CHEM 516 Analytical Chemistry (3)  
CHEM 517 Analytical Chemistry Laboratory (2)  
CHEM 624 (or CHEM 628) Organic Chemistry I (3)  
CHEM 625 Organic Chemistry I Laboratory (2)  
CHEM 626 (or CHEM 630) Organic Chemistry II (3)  
CHEM 627 Organic Chemistry II Laboratory (2)  
CHEM 635 Instrumental Methods of Analysis (2)  
CHEM 636 Instrumental Methods of Analysis Laboratory (2)  
CHEM 646 Physical Chemistry I (3)  
CHEM 647 Physical Chemistry I Laboratory (2)  
CHEM 648 Physical Chemistry II (4)  
CHEM 649 Physical Chemistry II Laboratory (2)  
CHEM 667 Systematic Inorganic Chemistry (3)  
CHEM 668 Advanced Inorganic Laboratory (2)  
CHEM 695 Seminar II (0.5)  

Plus one or more of the following courses:

CHEM 698 (or CHEM 699) Undergraduate Research Problems or  
700-level course (4)

**Mathematics, Physics and Biochemistry** 26-27 hours

MATH 121 Calculus I (5)  
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
MATH 320 Elementary Differential Equations (or honors equivalent) (3)
MATH 290 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)
BIOL 600 Introductory Biochemistry, Lectures (4) or
BIOL 636 Biochemistry I (3)

Other Requirements 27-29 hours

*Additional language or skill (A course in French, German, Russian, Japanese, Chinese, Spanish, or EECS 138, CHEM 711, MATH 526 or MATH 320 or another language or skill course) (3-5).

English (ENGL 101 and 102) (6)

Western civilization (6)

Humanities (6)

Social Sciences (6)

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. An overall average grade of C must be earned in all upper-level KU courses in chemistry.

*Native speakers must demonstrate ability to translate selected material into acceptable scientific English. Although a second language is no longer required for the B.S. degree, both the chemistry department and the ACS strongly recommend study of a second language.

Requirements for the B.S. Degree (New)

The significant differences between the B.S. and B.A. lie in the distribution requirements and the required subjects. This outline lists all required courses and some suggested electives. The program satisfies College requirements as well as certification standards of the American Chemical Society.

Chemistry Courses 50 hours

CHEM 170 Chemistry for the Chemical Sciences I (5) or
CHEM 130 General Chemistry I (5) or
CHEM 190 Foundations of Chemistry I, Honors (5)
CHEM 175 Chemistry for the Chemical Sciences II (5) or
CHEM 135 General Chemistry II (5) or
CHEM 195 Foundations of Chemistry II, Honors (5)
CHEM 295 Seminar I (0.5)
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I, Honors (3)
CHEM 231 Organic Chemistry I Laboratory (2)
CHEM 235 Organic Chemistry II (3) or
CHEM 285 Organic Chemistry II, Honors (3)
CHEM 236 Organic Chemistry II Laboratory (2)
CHEM 530 Physical Chemistry I (3)
CHEM 531 Physical Chemistry I Laboratory (2)
CHEM 535 Physical Chemistry II (4)
CHEM 536 Physical Chemistry II Laboratory (2)
CHEM 620 Analytical Chemistry (3)
CHEM 621 Analytical Chemistry Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 660 Systematic Inorganic Chemistry (3)
CHEM 661 Advanced Inorganic Laboratory (2)
CHEM 695 Seminar II (0.5)

Plus one or more of the following courses:

CHEM 698 (or CHEM 699) Undergraduate Research Problems or
700-level course (4)

Mathematics, Physics and Biochemistry 26-27 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
MATH 320 Elementary Differential Equations (or honors equivalent) (3)
MATH 290 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)
BIOL 600 Introductory Biochemistry, Lectures (4) or
BIOL 636 Biochemistry I (3)

Other Requirements 24 hours

English (ENGL 101 and 102) (6)
Western civilization (6)
Humanities (6)
Social Sciences (6)

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. An overall average grade of C must be earned in all upper-level KU courses in chemistry.

Justification:

1) Renumbering of the courses so that all courses have higher numbers than their prerequisites and to make the numbering system more systematic.
2) Change in titles for courses formerly numbered CHEM 184 and 188 (new numbers CHEM 130 and 135, respectively)
3) Addition of a proposed new two-semester freshman chemistry sequence, CHEM 170 and 175.
4) The “foreign language or other research skill” requirement for BS Chemistry majors is a vestige of an earlier requirement for foreign language study that existed in our department. Historically, many important chemistry-related journals and books were written in German, Russian, Chinese, French, and Japanese. Accessing the chemistry literature on the inclusive scale needed for successful research required the reading of foreign language publications. Today, international scientific organizations recognize English as the common language for all formal communications. Manuscripts that are not authored in English are usually published in English concurrently, or they are published as an English translation very soon after their initial appearance. Research skills addressed by the “foreign language or other research skill” requirement were, historically, taught in curriculum-driven courses. Because the skills needed for modern chemistry research are best learned in the context of participation in faculty-directed research, the KU Chemistry
faculty voted unanimously that the “foreign language or other research skill” requirement be eliminated.

B.S. Major: Biological Chemistry Option (Current)

**Chemistry Courses** 50 hours

CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)
CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)
CHEM 295 Seminar I (0.5)
CHEM 516 Analytical Chemistry (3)
CHEM 517 Analytical Chemistry Laboratory (2)
CHEM 624 (or CHEM 628) Organic Chemistry I (3)
CHEM 625 Organic Chemistry I Laboratory (2)
CHEM 626 (or CHEM 630) Organic Chemistry II (3)
CHEM 627 Organic Chemistry II Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 646 Physical Chemistry I (3)
CHEM 647 Physical Chemistry I Laboratory (2)
CHEM 648 Physical Chemistry II (4)
CHEM 649 Physical Chemistry II Laboratory (2)
CHEM 667 Systematic Inorganic Chemistry (3)
CHEM 668 Advanced Inorganic Laboratory (2)
CHEM 695 Seminar II (0.5)

Plus one or more of the following courses:

CHEM 698 (or CHEM 699) Undergraduate Research Problems or 700-level course (4)

**Biology and Biochemistry Courses** 12 hours

BIOL 150 Principles of Molecular and Cellular Biology (or honors equivalent) (4)
BIOL 636 Biochemistry I (3)
BIOL 637 Introductory Biochemistry Laboratory (2)
BIOL 638 Biochemistry II (3)

**Biology Option Group** 3 hours

Choose one of the following:

BIOL 350 Principles of Genetics (3)
BIOL 400 Fundamentals of Microbiology (3)
BIOL 416 Cell Structure and Function (3) (BIOL 350 is a prerequisite)

**Mathematics and Physics** 23 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or MATH 320 Elementary Differential Equations (3)
MATH 290 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)

**Other Requirements** 21 hours
B.S. Major: Biological Chemistry Option (New)

Chemistry Courses  50 hours

CHEM 170 Chemistry for the Chemical Sciences I (5) or
CHEM 130 General Chemistry I (5) or
CHEM 190 Foundations of Chemistry I, Honors (5)
CHEM 175 Chemistry for the Chemical Sciences II (5) or
CHEM 135 General Chemistry II (5) or
CHEM 195 Foundations of Chemistry II, Honors (5)
CHEM 295 Seminar I (0.5)
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I, Honors (3)
CHEM 231 Organic Chemistry I Laboratory (2)
CHEM 235 Organic Chemistry II (3) or
CHEM 285 Organic Chemistry II, Honors (3)
CHEM 236 Organic Chemistry II Laboratory (2)
CHEM 530 Physical Chemistry I (3)
CHEM 531 Physical Chemistry I Laboratory (2)
CHEM 535 Physical Chemistry II (4)
CHEM 536 Physical Chemistry II Laboratory (2)
CHEM 620 Analytical Chemistry (3)
CHEM 621 Analytical Chemistry Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 660 Systematic Inorganic Chemistry (3)
CHEM 661 Advanced Inorganic Laboratory (2)
CHEM 695 Seminar II (0.5)

Plus one or more of the following courses:

CHEM 698 (or CHEM 699) Undergraduate Research Problems or
700-level course (4)

Biology and Biochemistry Courses  12 hours

BIOL 150 Principles of Molecular and Cellular Biology (or honors equivalent) (4)
BIOL 636 Biochemistry I (3)
BIOL 637 Introductory Biochemistry Laboratory (2)
BIOL 638 Biochemistry II (3)

Biology Option Group  3 hours

Choose one of the following:

BIOL 350 Principles of Genetics (3)
BIOL 400 Fundamentals of Microbiology (3)
BIOL 416 Cell Structure and Function (3) (BIOL 350 is a prerequisite)

Mathematics and Physics  23 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
MATH 320 Elementary Differential Equations (3)
MATH 290 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)

Other Requirements 21 hours

English (ENGL 101 and ENGL 102) (6)
Western civilization (6)
Humanities (3)
Social Sciences (6)

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. An overall average grade of C must be earned in all upper-level KU courses in chemistry.

Justification:

1) Renumbering of the courses so that all courses have higher numbers than their prerequisites and to make the numbering system more systematic.
2) Change in titles for courses formerly numbered CHEM 184 and 188 (new numbers CHEM 130 and 135)
3) Addition of a proposed new two semester freshman chemistry sequence, CHEM 170 and 175.

B.S. Major: Chemical Physics Option (Current)

This option allows students to focus on the theoretical basis of chemistry. Students are prepared for graduate programs or employment. The curriculum substitutes 4 physics or mathematics courses for 4 courses in the standard program.

Chemistry Courses 50 hours [This is incorrect; include change in justification]

CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)
CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)
CHEM 295 Seminar I (0.5)
CHEM 516 Analytical Chemistry (3)
CHEM 517 Analytical Chemistry Laboratory (2)
CHEM 624 (or CHEM 628) Organic Chemistry I (3)
CHEM 625 Organic Chemistry I Laboratory (2)
CHEM 626 (or CHEM 630) Organic Chemistry II (3)
CHEM 627 Organic Chemistry II Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 646 Physical Chemistry I (3)
CHEM 647 Physical Chemistry I Laboratory (2)
CHEM 648 Physical Chemistry II (4)
CHEM 649 Physical Chemistry II Laboratory (2)
CHEM 667 Systematic Inorganic Chemistry (3)
CHEM 668 Advanced Inorganic Laboratory (2)
CHEM 695 Seminar II (0.5)

Mathematics, Physics and Biology 29-30 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
MATH 320 Elementary Linear Algebra (2)
MATH 223 Vector Calculus (3)
MATH 290 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)
BIOL 600 Introductory Biochemistry, Lectures (4) or
BIOL 636 Biochemistry I (3)

**Chemical Physics Option Group I** 6-7 hours

Choose 2 courses:
- PHSX 313 General Physics III and PHSX 316 Intermediate Physics Laboratory I (4)
- PHSX 518 Mathematical Physics (3)
- PHSX 615 Numerical and Computational Methods in Physics (3)
- PHSX 521 Mechanics I (3)
- PHSX 623 Physics of Fluids (3)
- PHSX 655 Optics (3)
- PHSX 681 Concepts in Solids (3)

**Chemical Physics Option Group II** 6 hours

Choose 2 courses:
- PHSX 531 Electricity and Magnetism (3)
- PHSX 621 Mechanics II (3)
- MATH 646 Complex Variable and Applications (3)
- MATH 647 Applied Partial Differential Equations (3)
- CHEM 698 (or CHEM 699) Undergraduate Research (3)

(To count toward the chemical physics option, the research must have a clear chemical physics focus.)

**Other Requirements** 21 hours

English (ENGL 101 and ENGL 102) (6)
Western civilization (6)
Humanities (3)
Social Sciences (6)

B.S. Major: Chemical Physics Option (New)

This option allows students to focus on the theoretical basis of chemistry. Students are prepared for graduate programs or employment. The curriculum substitutes 4 physics or mathematics courses for 4 courses in the standard program.

**Chemistry Courses** 46 hours

CHEM 170 Chemistry for the Chemical Sciences I (5) or
CHEM 130 General Chemistry I (5) or
CHEM 190 Foundations of Chemistry I, Honors (5)
CHEM 175 Chemistry for the Chemical Sciences II (5) or
CHEM 135 General Chemistry II (5) or
CHEM 195 Foundations of Chemistry II, Honors (5)
CHEM 295 Seminar I (0.5)
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I, Honors (3)
CHEM 231 Organic Chemistry I Laboratory (2)
CHEM 235 Organic Chemistry II (3) or
CHEM 285 Organic Chemistry II, Honors (3)
CHEM 236 Organic Chemistry II Laboratory (2)
CHEM 530 Physical Chemistry I (3)
CHEM 531 Physical Chemistry I Laboratory (2)
CHEM 535 Physical Chemistry II (4)
CHEM 536 Physical Chemistry II Laboratory (2)
CHEM 620 Analytical Chemistry (3)
CHEM 621 Analytical Chemistry Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 660 Systematic Inorganic Chemistry (3)
CHEM 661 Advanced Inorganic Laboratory (2)
CHEM 695 Seminar II (0.5)

**Mathematics, Physics and Biology** 29-30 hours

- MATH 121 Calculus I (5)
- MATH 122 Calculus II (5)
- MATH 220 Applied Differential Equations (3) or
- MATH 320 Elementary Linear Algebra (2)
- MATH 223 Vector Calculus (3)
- MATH 290 Elementary Linear Algebra (2)
- PHSX 211 General Physics I (4)
- PHSX 212 General Physics II (4)
- BIOL 600 Introductory Biochemistry, Lectures (4) or
- BIOL 636 Biochemistry I (3)

**Chemical Physics Option Group I** 6-7 hours

Choose 2 courses:
- PHSX 313 General Physics III and PHSX 316 Intermediate Physics Laboratory I (4)
- PHSX 518 Mathematical Physics (3)
- PHSX 615 Numerical and Computational Methods in Physics (3)
- PHSX 521 Mechanics I (3)
- PHSX 623 Physics of Fluids (3)
- PHSX 655 Optics (3)
- PHSX 681 Concepts in Solids (3)

**Chemical Physics Option Group II** 6 hours

Choose 2 courses:
- PHSX 531 Electricity and Magnetism (3)
- PHSX 621 Mechanics II (3)
- MATH 646 Complex Variable and Applications (3)
- MATH 647 Applied Partial Differential Equations (3)
- CHEM 698 (or CHEM 699) Undergraduate Research (3)

(To count toward the chemical physics option, the research must have a clear chemical physics focus.)

**Other Requirements** 21 hours

- English (ENGL 101 and ENGL 102) (6)
- Western civilization (6)
- Humanities (3)
Social Sciences (6)

**Justification:**

1) Renumbering of the courses so that all courses have higher numbers than their prerequisites and to make the numbering system more systematic.
2) Change in titles for courses formerly numbered CHEM 184 and 188 (new numbers CHEM 130 and 135)
3) Addition of a proposed new two semester freshman chemistry sequence, CHEM 170 and 175.
4) Correction to the total number of chemistry course hours required for this option (actual number of hours is 46).

**B.S. Major: Environmental Chemistry Option (Current)**

This option allows students to focus on environmental issues and to understand how chemistry may be applied to environmental problems. Students are prepared for graduate programs or employment. The curriculum substitutes four environmentally related courses for four courses in the standard B.S. program. The program satisfies College requirements as well as American Chemical Society standards.

**Chemistry Courses**  44 hours

CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)
CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)
CHEM 295 Seminar I (0.5)
CHEM 516 Analytical Chemistry (3)
CHEM 517 Analytical Chemistry Laboratory (2)
CHEM 624 (or CHEM 628) Organic Chemistry I (3)
CHEM 625 Organic Chemistry I Laboratory (2)
CHEM 626 (or CHEM 630) Organic Chemistry II (3)
CHEM 627 Organic Chemistry II Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 646 Physical Chemistry I (3)
CHEM 647 Physical Chemistry I Laboratory (2)
CHEM 648 Physical Chemistry II (4)
CHEM 649 Physical Chemistry II Laboratory (2)
CHEM 667 Systematic Inorganic Chemistry (3)
CHEM 695 Seminar II (0.5)

**Mathematics and Physics**  23 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
MATH 320 Elementary Linear Algebra (2)

PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)

Environmental Chemistry Option Group I  6-8 hours

Choose 2 courses:

BIOL 100 Principles of Biology (3) or
BIOL 150 Principles of Molecular and Cellular Biology (4)
EVRN 148 Scientific Principles of Environmental Studies (3)
GEOG 304 Environmental Conservation (3)
GEOL 351 Environmental Geology (3)
BIOL 400 Fundamentals of Microbiology (3)
BIOL 414 Principles of Ecology (3)
BIOL 600 Introductory Biochemistry, Lectures (4)
ATMO 105 Introductory Meteorology (5)

**Environmental Chemistry Option Group II 6-7 hours**

Choose 2 courses:

- BIOL 660 Lake Ecology (with or without BIOL 662) Aquatic Ecology Laboratory (3-5)
- CE 477 Introduction to Environmental Engineering and Science (3)
- GEOL 552 Introduction to Hydrogeology (3)
- ATMO 525 Air Pollution Meteorology (3)
- EVRN 611 Water Quality, Land Use, and Watershed Ecosystems (3)
- CHEM 698 Undergraduate Research Problems (3) (CHEM 698 is strongly recommended for all students in this option. To count toward this option, the research must have a clear environmental focus and may not be taken until completion of CHEM 516 and CHEM 517 and consultation with a chemistry major adviser.)

**Note:** All 4 courses chosen from Groups I and II may not be in the same department or division.

**Other Requirements 26 hours**

- *Additional language or skill (A course in French, German, Russian, Japanese, Chinese, Spanish, or EECS 138, CHEM 711, MATH 526 or MATH 320, or another language or skill course)*
- English (ENGL 101 and ENGL 102) (6)
- Western civilization (6)
- Humanities (6)
- Social Sciences (6)

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. An overall average grade of C must be earned in all upper-level KU courses in chemistry.

- *Native speakers must demonstrate ability to translate selected material into acceptable scientific English. Although a second language is no longer required for the B.S. degree, both the chemistry department and the ACS strongly recommend study of a second language.*

**B.S. Major: Environmental Chemistry Option (New)**

This option allows students to focus on environmental issues and to understand how chemistry may be applied to environmental problems. Students are prepared for graduate programs or employment. The curriculum substitutes four environmentally related courses for four courses in the standard B.S. program. The program satisfies College requirements as well as American Chemical Society standards.

**Chemistry Courses 44 hours**

- CHEM 170 Chemistry for the Chemical Sciences I (5) or
- CHEM 130 General Chemistry I (5) or
- CHEM 190 Foundations of Chemistry I, Honors (5)
- CHEM 175 Chemistry for the Chemical Sciences II (5) or
- CHEM 135 General Chemistry II (5) or
- CHEM 195 Foundations of Chemistry II, Honors (5)
- CHEM 295 Seminar I (0.5)
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I, Honors (3)
CHEM 231 Organic Chemistry I Laboratory (2)
CHEM 235 Organic Chemistry II (3) or
CHEM 285 Organic Chemistry II, Honors (3)
CHEM 236 Organic Chemistry II Laboratory (2)
CHEM 530 Physical Chemistry I (3)
CHEM 531 Physical Chemistry I Laboratory (2)
CHEM 535 Physical Chemistry II (4)
CHEM 536 Physical Chemistry II Laboratory (2)
CHEM 620 Analytical Chemistry (3)
CHEM 621 Analytical Chemistry Laboratory (2)
CHEM 635 Instrumental Methods of Analysis (2)
CHEM 636 Instrumental Methods of Analysis Laboratory (2)
CHEM 660 Systematic Inorganic Chemistry (3)
CHEM 695 Seminar II (0.5)

**Mathematics and Physics** 23 hours

MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
MATH 220 Applied Differential Equations (3) or
     MATH 320 Elementary Linear Algebra (2)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)

**Environmental Chemistry Option Group I** 6-8 hours

Choose 2 courses:

BIOL 100 Principles of Biology (3) or
BIOL 150 Principles of Molecular and Cellular Biology (4)
EVRN 148 Scientific Principles of Environmental Studies (3)
GEOG 304 Environmental Conservation (3)
GEOL 351 Environmental Geology (3)
BIOL 400 Fundamentals of Microbiology (3)
BIOL 414 Principles of Ecology (3)
BIOL 600 Introductory Biochemistry, Lectures (4)
ATMO 105 Introductory Meteorology (5)

**Environmental Chemistry Option Group II** 6-7 hours

Choose 2 courses:

BIOL 660 Lake Ecology (with or without BIOL 662) Aquatic Ecology Laboratory) (3-5)
CE 477 Introduction to Environmental Engineering and Science (3)
GEOL 552 Introduction to Hydrogeology (3)
ATMO 525 Air Pollution Meteorology (3)
EVRN 611 Water Quality, Land Use, and Watershed Ecosystems (3)
CHEM 698 Undergraduate Research Problems (3) (CHEM 698 is strongly recommended for all students in this option. To count toward this option, the research must have a clear environmental focus and may not be taken until completion of CHEM 620 and CHEM 621 and consultation with a chemistry major adviser.)

**Note:** All 4 courses chosen from Groups I and II may not be in the same department or division.

**Other Requirements** 24 hours

English (ENGL 101 and ENGL 102) (6)
Western civilization (6)  
Humanities (6)  
Social Sciences (6)  

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. An overall average grade of C must be earned in all upper-level KU courses in chemistry.

**Justification:**

1. Renumbering of the courses so that all courses have higher numbers than their prerequisites and to make the numbering system more systematic.
2. Change in titles for courses formerly numbered CHEM 184 and 188 (new numbers CHEM 130 and 135)
3. Addition of a proposed new two semester freshman chemistry sequence, CHEM 170 and 175.
4. The “foreign language or other research skill” requirement for BS Chemistry majors is a vestige of an earlier requirement for foreign language study that existed in our department. Historically, many important chemistry-related journals and books were written in German, Russian, Chinese, French, and Japanese. Accessing the chemistry literature on the inclusive scale needed for successful research required the reading of foreign language publications. Today, international scientific organizations recognize English as the common language for all formal communications. Manuscripts that are not authored in English are usually published in English concurrently, or they are published as an English translation very soon after their initial appearance. Research skills addressed by the “foreign language or other research skill” requirement were, historically, taught in curriculum-driven courses. Because the skills needed for modern chemistry research are best learned in the context of participation in faculty-directed research, the KU Chemistry faculty voted unanimously that the “foreign language or other research skill” requirement be eliminated.

**Requirements for the Chemistry Minor (Current)**

**Requirements for the Minor:**

The minor allows students outside the department to obtain a strong, distributed background in the discipline. It is particularly useful for students anticipating careers in medicine, allied health, biological sciences, environmental sciences, chemical engineering, business, law, secondary education, or any career in which a basic understanding of the molecular sciences is helpful. A total of 23 credit hours is required. Students should see a chemistry department adviser early in the junior year. Some of the required courses are only offered once per year.

**Required Courses** (15 hours)

- CHEM 184 (or CHEM 185) Foundations of Chemistry I (5)
- CHEM 188 (or CHEM 189) Foundations of Chemistry II (5)
- CHEM 622 Fundamentals of Organic Chemistry (3) or CHEM 624 Organic Chemistry I (3) or CHEM 628 Organic Chemistry I (3)
- CHEM 625 Organic Chemistry I Laboratory (2)

**Elective Group I** (5 hours)

Choose 1 of the following:

- CHEM 640 Biological Physical Chemistry (3) and CHEM 641 Biological Physical Chemistry Laboratory (2) or
- CHEM 646 Physical Chemistry I (3) and CHEM 647 Physical Chemistry Laboratory I (2)
- CHEM 516 Analytical Chemistry (3) and CHEM 517 Analytical Chemistry Laboratory (2)
Elective Group II (3 hours)
Choose 1 of the following:
CHEM 640 Biological Physical Chemistry (3) or
CHEM 646 Physical Chemistry I (3)
CHEM 667 Systematic Inorganic Chemistry (3)

Requirements for the Chemistry Minor (New)
Requirements for the Minor:

The minor allows students outside the department to obtain a strong, distributed background in the discipline. It is particularly useful for students anticipating careers in medicine, allied health, biological sciences, environmental sciences, chemical engineering, business, law, secondary education, or any career in which a basic understanding of the molecular sciences is helpful. A total of 23 credit hours is required. Students should see a chemistry department adviser early in the junior year. Some of the required courses are only offered once per year.

Required Courses (15 hours)
CHEM 170 Chemistry for the Chemical Sciences I (5) or
CHEM 130 General Chemistry I (5) or
CHEM 190 Foundations of Chemistry I, Honors (5)
CHEM 175 Chemistry for the Chemical Sciences II (5) or
CHEM 135 General Chemistry II (5) or
CHEM 195 Foundations of Chemistry II, Honors (5)
CHEM 210 Fundamentals of Organic Chemistry (3) or
CHEM 230 Organic Chemistry I (3) or
CHEM 280 Organic Chemistry I (3)
CHEM 231 Organic Chemistry I Laboratory (2)

Elective Group I (5 hours)
Choose 1 of the following:
CHEM 510 Biological Physical Chemistry (3) and
CHEM 511 Biological Physical Chemistry Laboratory (2) or
CHEM 530 Physical Chemistry I (3) and
CHEM 531 Physical Chemistry Laboratory I (2)
CHEM 620 Analytical Chemistry (3) and
CHEM 621 Analytical Chemistry Laboratory (2)

Elective Group II (3 hours)
Choose 1 of the following:
CHEM 510 Biological Physical Chemistry (3) or
CHEM 530 Physical Chemistry I (3)
CHEM 660 Systematic Inorganic Chemistry (3)

Chemistry Related Changes
CHEMISTRY RELATED DEGREE REQUIREMENT CHANGES
Requirements for the B.A. Major in Astronomy
In addition to general education requirements for B.A. degrees in the College, 39.5 hours of astronomy, physics, mathematics, and chemistry are required.

Foundational Physics, Mathematics, and Basic Science 23.5 hours
PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics (0.5)
PHSX 211 (or PHSX 213) General Physics I (4) and
PHSX 212 (or PHSX 214) General Physics II (4)
MATH 121 Calculus I (5) and
MATH 122 Calculus II (5)
CHEM 130 Foundations of General Chemistry I (5)
Astronomy Requirements 16 hours
ASTR 196 Introductory Astronomy Laboratory (1) or
ASTR 596 Observational Astrophysics (1)
ASTR 391 Physical Astronomy, Honors (3)
ASTR 390 Undergraduate Problems (3)
ASTR 591 Stellar Astronomy (3)
ASTR 592 Galactic and Extragalactic Astronomy (3)
PHSX 693 Gravitation and Cosmology (3) or
ASTR 691 Astrophysics I (3) or
GEOL 572 Geophysics (3)

Requirements for the B.S. Degree in Astronomy

Foundational Physics, Mathematics, and Basic Science 23.5 hours
PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics (0.5)
PHSX 211 (or PHSX 213) General Physics I (4) and
PHSX 212 (or PHSX 214) General Physics II (4)
MATH 121 Calculus I (5) and
MATH 122 Calculus II (5)
CHEM 484 130 Foundations of General Chemistry I (5)

Astronomy Requirements 20 hours
ASTR 391 Physical Astronomy, Honors (3)
ASTR 596 Observational Astrophysics (1)
ASTR 591 Stellar Astronomy (3)
ASTR 592 Galactic and Extragalactic Astronomy (3)
PHSX 693 Gravitation and Cosmology (3)
ASTR 691 Astrophysics I (3)
ASTR 692 Astrophysics II (3)
ASTR 503 Undergraduate Research (1)

Physics Requirements 23 hours
PHSX 313 General Physics III (3) and
PHSX 316 Intermediate Physics Laboratory I (1)
PHSX 511 Introductory Quantum Mechanics (3)
PHSX 521 Mechanics I (3)
PHSX 531 Electricity and Magnetism (3)
PHSX 536 Electronic Circuit Measurement and Design (4) or
PHSX 516 Physical Measurements (4)
PHSX 671 Thermal Physics (3)
Advanced physics elective (3) (any lecture or laboratory course numbered 500 or higher, including ASTR 795/PHSX 795 Space Plasma Physics and GEOL 572 Geophysics)

Advanced Mathematics Requirements 11 hours
MATH 223 Vector Calculus (3) and
MATH 290 Elementary Linear Algebra (2)
MATH 320 Elementary Differential Equations (3)
MATH elective (3) (This may be chosen from PHSX 518, PHSX 718, MATH 526, MATH 530, MATH 558, MATH 581, MATH 590, MATH 628, MATH 646, MATH 647, MATH 648,
MATH 660, MATH 661, or any 700-level MATH lecture course except MATH 701 and MATH 715.)

Other Requirements

- **English:** satisfaction of the B.A. requirements. If requirements can be met in fewer than 9 hours, the remaining hours become free electives (ENGL 362 Foundations of Technical Writing is accepted as the third English course) (9)
- **Humanities:** 2 courses, including at least 1 principal course (6)
- **Social sciences:** 2 courses, including at least 1 principal course (6)
- Western civilization (6)
- **EECS 138** Introduction to Computing: FORTRAN or C++ (3) **or**
- **EECS 168** Programming I (4)
- Additional credit hours of free electives in courses outside the major are needed to complete the required 120 credit hours

Requirements for the B.S. Degree in Atmospheric Science

4 specialized options are available for students who plan professional careers in meteorology or atmospheric science. The **general meteorology** option satisfies all the traditional professional meteorology requirements for employment with the National Weather Service, airlines, or other agencies. The **air pollution meteorology** option may lead to a career as a meteorologist in one of the many water-related activities in private and governmental agencies. The **news media forecasting** option can lead to a career forecasting the weather on television or radio. The B.S. degree with any of these specialties also prepares students to begin graduate programs in meteorology or atmospheric science.

**General Requirements for All Options 94-95 hours**

**ATMO 105** Introductory Meteorology (5)
**ATMO 321/GEOG 321** Climate and Climate Change (3)
**ATMO 505** Weather Forecasting (3)
**ATMO 521/GEOG 521** Microclimatology (3)
**ATMO 630** Synoptic Meteorology (3)
**ATMO 640** Dynamic Meteorology (3)
**ATMO 642** Remote Sensing (3)
**ATMO 660** Advanced Dynamic Meteorology (3)
**ATMO 680** Physical Meteorology (3)
**ATMO 697** Seminar for Seniors (1)
**CHEM 184 130** Foundations of General Chemistry I (5)
**COMS 130** Speaker-Audience Communication (3) **or**
**COMS 150** Personal Communication (3) **and**
**COMS 330** Effective Business Communication (3)
**EECS 138** Introduction to Computing: FORTRAN (3)
**ENGL 101, ENGL 102, and**
any 200-level English course **or**
**ENGL 362** Foundations of Technical Writing (9)
**EVRN 148** Scientific Principles of Environmental Studies (3)
**MATH 581** Numerical Methods (3)
**MATH 121, MATH 122, MATH 223, MATH 290, MATH 320 or MATH 220, MATH 526**
Applied Mathematical Statistics I or **DSCI 301** Statistics (21-22)
PHSX 211 General Physics I (4)
PHSX 212 General Physics II (4)
Humanities and social sciences (one course each) (6)

**General Meteorology Option**
ATMO 525 Air Pollution Meteorology (3)
ATMO 605 Operational Forecasting (2)
ATMO 650 Advanced Synoptic Meteorology (3)
Additional credit hours of general electives are needed to meet the minimum total hours required for graduation.

**Air Pollution Meteorology Option**
ATMO 525 Air Pollution Meteorology (3)
CHEM 488 Foundations of General Chemistry II (5)
CE 477 Introduction to Environmental Engineering and Science (3)
Additional credit hours of general electives are needed to meet the minimum total hours required for graduation.

**Hydrometeorology Option**
ATMO 525 Air Pollution Meteorology (3)
ATMO 605 Operational Forecasting (2)
CE 301 Statics and Dynamics (5)
CE 330 Fluid Mechanics (4)
CE 455 Hydrology (3)
Additional credit hours of general electives are needed to meet the minimum total hours required for graduation.

**News Media Forecasting Option**
ATMO 605 Operational Forecasting (2)
ATMO 650 Advanced Synoptic Meteorology (3)
JOUR 301 Research and Writing (3)
JOUR 415 Multimedia Reporting (3)
JOUR 512 Principles of Broadcasting, Cable, and New Technologies (3)
Additional credit hours of general electives are needed to meet the minimum total hours required for graduation.

**Requirements for the B.A. Biochemistry**

**B.A. Biochemistry**
General Science Requirements 35-39 hours

CHEM 184 Foundations of Chemistry I (5)
CHEM 170 Chemistry for the Chemical Sciences I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5)
CHEM 175 Chemistry for the Chemical Sciences II (or CHEM 195 Honors) (5)
CHEM 624 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 Organic Chemistry I Laboratory (2)
CHEM 626 Organic Chemistry II (or CHEM 285 Honors) (3)
CHEM 640 Biological Physical Chemistry (3)

*MATH 121 Calculus I (5) and *MATH 122 Calculus II (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)  *Students who plan to attend graduate school should enroll in MATH 121 and MATH 122.
PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4) or PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4)

Requirements for the B.S. Biochemistry Degree

B.S. Biochemistry
General Science Requirements 45 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 170 Chemistry for the Chemical Sciences I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 175 Chemistry for the Chemical Sciences II (or CHEM 195 Honors) (5)
CHEM 546 620 Analytical Chemistry (3)
CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
CHEM 626 235 Organic Chemistry II (or CHEM 285 Honors) (3)
CHEM 627 236 Organic Chemistry II Laboratory (2)
CHEM 640 510 Biological Physical Chemistry (3) or CHEM 646 530 Physical Chemistry I (3)
MATH 121 Calculus I (5)
MATH 122 Calculus II (5)
PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4) or PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4)

Requirements for the B.A. Biology Major

B.A. Biology
General Science Requirements 28-29 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

Requirements for the B.S. Biology Degree – all emphases

B.S. Biology/Cell Biology
General Science Requirements 31-32 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3) (required for cell biology) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
CHEM 626 235 Organic Chemistry II (or CHEM 285 Honors) (3)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
**B.S. Biology/Ecology & Evolutionary Biology**
General Science Requirements 25-28 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

**B.S. Biology/Genetics**
General Science Requirements 28-29 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
* CHEM 625 231 Organic Chemistry I Laboratory (2) *Students who plan to attend graduate school (particularly those interested in applying molecular techniques) or medical school should also enroll in CHEM 626 235 and CHEM 627 236.
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

**B.S. Biology/Neurobiology**
General Science Requirements 31-32 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
CHEM 626 235 Organic Chemistry II (or CHEM 285 Honors) (3)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

**B.S. Biology/Organismal Biology**
General Science Requirements 28-29 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
B.S. Biology/Teaching Biology

General Science Requirements 28-29 hours

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

Requirements for the B.A. Human Biology Major

B.A. Human Biology, all five subplans

General Science Requirements 33 hours minimum

ANTH 304 Fundamentals of Physical Anthropology (3-4)
BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology (4)
BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology (4)
MATH 115 Calculus I (3) and MATH 116 Calculus II (3) or MATH 121 Calculus I (5)
CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
PHSX 114 College Physics I (4) or PHSX 211 General Physics I (4)
*BIO 570 Introduction to Biostatistics (3) or PSYC 210 Statistics in Psychological Research (3) or MATH 365 Elementary Statistics (3)

B.A. Human Biology/Anthropology

Anthropology Concentration 30 hours minimum

Organic Chemistry: CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
Cell Biology: BIOL 416 Cell Structure and Function (3)
Genetics: BIOL 350 Principles of Genetics (3)
Seminar: BIOL 599 Senior Seminar: Human Biology (must be taken in senior year) (1)

B.A. Human Biology/Biology

Biology Concentration 31 hours minimum

Organic Chemistry: CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
Physics: PHSX 115 College Physics II (4) or PHSX 212 General Physics II (4)
Genetics: BIOL 350 Principles of Genetics (3)
Seminar: BIOL 599 Senior Seminar: Human Biology (must be taken in senior year) (1)

B.A. Human Biology/Psychology

Psychology Concentration 30 hours minimum
Organic Chemistry: CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
Genetics: BIOL 350 Principles of Genetics (3)
Research Methods: PSYC 200 Research Methods in Psychology (3)
Seminar: BIOL 599 Senior Seminar: Human Biology (must be taken in senior year) (1)

Requirements for the B.A. Microbiology Major

B.A. Microbiology
General Science Requirements 34-35 hours

BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology (4)
BIOL 350 Principles of Genetics (3)
CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 622 210 Fundamentals of Organic Chemistry (3) or CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
MATH 115 Calculus I (3) and MATH 116 Calculus II (3) or MATH 121 Calculus I (5)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)

Requirements for the B.S. Microbiology Degree

B.S. Microbiology
General Science Requirements 49-50 hours

BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology (4)
BIOL 350 Principles of Genetics (3)
CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5) CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
CHEM 626 235 Organic Chemistry II (or CHEM 285 Honors) (3)
CHEM 627 236 Organic Chemistry II Laboratory (2)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
BIOL 570 Introduction to Biostatistics (3) or MATH 365 Elementary Statistics (3) or PSYC 210 Statistics in Psychological Research (3)
BIOL 636 Biochemistry I (3)
BIOL 638 Biochemistry II (3)

Requirements for the B.S. Molecular Biosciences Degree

B.S. Molecular Biosciences
General Science Requirements 36-37 hours minimum

CHEM 184 Foundations of Chemistry I (5) CHEM 130 General Chemistry I (or CHEM 190 Honors) (5)
CHEM 188 Foundations of Chemistry II (5)  CHEM 135 General Chemistry II (or CHEM 195 Honors) (5)
CHEM 624 230 Organic Chemistry I (or CHEM 280 Honors) (3)
CHEM 625 231 Organic Chemistry I Laboratory (2)
CHEM 626 235 Organic Chemistry II (or CHEM 285 Honors) (3)
CHEM 627 236 Organic Chemistry II Laboratory (2)
PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4) or
PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
MATH 121 Calculus I (5) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
BIOL 570 Introduction to Biostatistics (3) or MATH 365 Elementary Statistics (3) or PSYC 210 Statistics in Psychological Research (3)

Requirements for the B.S. Degree Environmental Studies

B.S. Major Courses

64 to 70 hours are required.

Introduction to Science and Culture 6-10 hours

- EVRN 140 Global Environment I: The Discovery of Environmental Change (3) and EVRN 141 Global Environment I: Interdisciplinary Laboratory (2) or
- EVRN 148/GEOG 148 Scientific Principles of Environmental Studies (3) or EVRN 149/GEOG 149 Scientific Principles of Environmental Studies Honors (3)
- And choose one of the following:
  EVRN 142 Global Environment II: The Ecology of Human Civilization (3) and EVRN 143 Global Environment II: Interdisciplinary Laboratory (2) or EVRN 103/HIST 103 Environment and History or EVRN 347/HIST 347 Environmental History of North America (3) or EVRN 150/GEOG 150 Environment, Culture, and Society (3)

Mathematics 5-6 hours

- MATH 115 Calculus (3) and MATH 116 Calculus II (3) or
- MATH 121 Calculus I (5)

Statistics 3-4 hours

Choose one of the following:

- MATH 365 Elementary Statistics (3)
- GEOG 316 Methods of Analyzing Geographical Data (4)
- BIOL 570 Introduction to Biostatistics (3)

Core Courses 12 hours

- EVRN 320 Environmental Policy Analysis (3)
- EVRN 332 Environmental Law (3)
- EVRN 460 Field Ecology (3)
- EVRN 615 Capstone Project (3)

Biology and Ecology 11 hours

- BIOL 150 Principles of Molecular and Cellular Biology (4) or
- BIOL 151 Principles of Molecular And Cellular Biology, Honors (4)
- BIOL 152 Principles of Organismal Biology (4) or
  BIOL 153 Principles of Organismal Biology, Honors (4)
- BIOL 414 Principles of Ecology (3)

Chemistry 10 hours
- CHEM 184 130 Foundations of General Chemistry I (5) or
  CHEM 185 135 Foundations of General Chemistry I, Honors (5)
- CHEM 188 190 Foundations of Chemistry II (5) or
  CHEM 189 195 Foundations of Chemistry II, Honors (5)

Additional Laboratory Science 5 hours
- GEOG 104 Principles of Physical Geography (3) and
  GEOG 105 Introductory Laboratory in Physical Geography (2)
- GEOL 101 Introduction to Geology (3) and
  GEOL 103 Geological Fundamentals Laboratory (2)
- GEOL 102 Introduction to Geology, Honors (3) and
  GEOL 103 Geological Fundamentals Laboratory (2)
- CHEM 622 Fundamentals of Organic Chemistry (3) and
  CHEM 625 Organic Chemistry I Laboratory (2)

Electives 12 hours minimum
A minimum of 12 hours is required at the 300-level and above, with at least one course with the EVRN prefix.

Requirements for the B.S. Degree Geography

B.S. students must select 1 of the options below (physical geography or geographical information and analysis). A total of 120 credit hours is required, of which 45 must be junior/senior hours, 30 must be KU residence hours, no more than 64 may be community college transfer hours, no more than 6 may be music organization hours, and no more than 4 may be physical education hours. An overall grade-point average of 2.0 is required, with an average of 2.0 in geography junior/senior courses.

Physical Geography Option

General Requirements
- English (ENGL 101 or exemption) (0-3)
- ENGL 102 (or ENGL 105 or exemption) (0-3)
- 200/300-level English course or above (e.g., ENGL 362 recommended) (3)
- COMS 130 (COMS 230, PHIL 148, PHIL 310, or exemption) (0-3)
- History or philosophy of science (3)
  (Choose 1 of the following or consult undergraduate committee for approval of alternatives: HIST 103, HIST 136, HIST 305, HIST 306, HIST 311, HIST 347, HIST 360, HIST 407, PHIL 365, PHIL 370, PHIL 375, PHIL 380, PHIL 620, PHIL 622, GEOG 357)
- 2 principal courses in the humanities (6)
- 2 principal courses in the social sciences (6)

Preparation for the Major
• MATH 121 Calculus I (5) and MATH 122 Calculus II (recommended) (5) or
  MATH 115 Calculus I (3) and MATH 116 Calculus II (3)
• PHSX 211 General Physics I and PHSX 212 General Physics II (8) (recommended) or
  PHSX 114 College Physics I and PHSX 115 College Physics II (6-8)
• BIOL 150 Principles of Molecular and Cellular Biology (4)
• BIOL 152 Principles of Organismal Biology (4)
• CHEM 130 Foundations of General Chemistry I (5)
• CHEM 135 Foundations of General Chemistry II (5)
• EECS 128 Foundations of Information Technology: _____ or equivalent (3)

Geography Requirements

Overview Courses
• GEOG 104 Principles of Physical Geography (3) or
  GEOG 107 Principles of Physical Geography, Honors (3)
• GEOG 105 Introductory Laboratory in Physical Geography (2)
• GEOG 100 (or GEOG 101) World Regional Geography (3) or
  GEOG 102 (or GEOG 103) Principles of Human Geography (3)

Foundation Courses
1. Physical: Choose 3 of the following: (9-10)
   GEOG 304 Environmental Conservation
   GEOG 321 Climate and Climate Change
   GEOG 331 Regional Geomorphology of the United States
   GEOG 338 Introduction to River Systems
   GEOG 335 Introduction to Soil Geography or GEOG 535 Soil Geography
2. Techniques: The following are required: (12)
   GEOG 316 Methods of Analyzing Geographical Data
   GEOG 358 Principles of Geographic Information Systems
   GEOG 526 Remote Sensing of Environment I
3. Field Experience: Choose 1 of the following: (3-4)
   EVRN 460 Field Ecology
   GEOG 433 Biogeography Field and Laboratory Techniques
   GEOG 714 Field Experience

Elective Courses
• 6 additional hours from the physical geography course list (300 level or above) (6)
• 6 additional hours of geography (any group, 300 level or above) (6)
• 6 additional hours in an allied field (e.g., ATMO, BIOL, EVRN, or GEOL) approved by geography adviser (6)

Requirements for the B.A. Geology Major

Requirements for the B.A. Major

In addition to College requirements, these courses are required:

• MATH 115 Calculus I (3) or
  MATH 121 Calculus I (5)
• CHEM 184 Foundations of Chemistry I or CHEM 125 College Chemistry (5)
• PHSX 111 Introductory Physics (3) or PHSX 114 College Physics I (4) or PHSX 211 General Physics I (4)
• BIOL 100 Principles of Biology (3)
• BIOL 102 Principles of Biology Laboratory (1)
• EECS 128 Foundations of Information Technology: _____ (3) or EECS 138 Introduction to Computing: _____ (3)

Geology Core 24 hours
• GEOL 101 Introduction to Geology (3) and GEOL 103 Geology Fundamentals Laboratory (2)
• GEOL 311 Mineralogy and Structure of the Earth (3)
• GEOL 331 Sedimentology and Surface Processes (4)
• GEOL 360 Field Investigation (2)
• GEOL 521 Paleontology (3)
• GEOL 560 Introductory Field Geology (3)
• GEOL 562 Structural Geology (4)

Requirements for the B.S. Geology Degree – all emphases

General Geology Option
• Satisfaction of the College English requirement (6-9)
• COMS 130 Speaker-Audience Communication (3) or COMS 150 Personal Communication (3) (or exemption)
• 2 courses in the humanities (6-10)
• 2 courses in the social sciences (an introductory course in economics is recommended) (6-8)
• MATH 121 Calculus I (5) and MATH 122 Calculus II (5) (recommended) or MATH 115 Calculus I (3) and MATH 116 Calculus II (3) plus MATH 122 Calculus II (5)
• PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
• CHEM 184 Foundations of Chemistry I or CHEM 130 General Chemistry I (5) and CHEM 188 Foundations of Chemistry II or CHEM 135 General Chemistry II (5)
• BIOL 150 Principles of Molecular and Cellular Biology (4) and BIOL 152 Principles of Organismal Biology (4)
• EECS 128 Foundations of Information Technology: _____ (3) or EECS 138 Introduction to Computing: _____ (3) or C&PE 121 Introduction to Computers in Engineering (3)

Geology 49 hours
• GEOL 101 Introduction to Geology (3) and GEOL 103 Geology Fundamentals Laboratory (2)
• GEOL 311 Mineralogy and Structure of the Earth (3)
• GEOL 312 Mineral Structures and Equilibria Laboratory (1)
• GEOL 331 Sedimentology and Surface Processes (4)
• GEOL 360 Field Investigation (2)
• GEOL 512 Igneous and Metamorphic Petrology (3)
• GEOL 513 Petrology Laboratory (1)
- GEOL 521 Paleontology (3)
- GEOL 523 Paleontology Laboratory (1)
- GEOL 532 Stratigraphy (4)
- GEOL 560 Introductory Field Geology (3)
- GEOL 561 Field Geology (3)
- GEOL 562 Structural Geology (4)
- GEOL 572 Geophysics (3) or GEOL 573 Geodynamics and Plate Tectonics (3)
- At least 9 hours in geology courses numbered 500 or above (9)
  This can include 3 hours of GEOL 399, GEOL 105, GEOL 304, or GEOL 121 can also count if taken before the student has completed 60 hours. Electives may include an upper-division course in statistics (MATH 365 or BIOL 570).

Engineering Geology Option

- ENGL 101, ENGL 102, and ENGL 362 (9)
- COMS 130 Speaker-Audience Communication (3) or
  COMS 150 Personal Communication (3) (or exemption)
- 2 courses in the humanities (6-10)
- ECON 104 Introductory Economics (4)
- 1 additional course in the social sciences (3)
- MATH 121, MATH 122, MATH 220, and MATH 290 (15)
- CHEM 130 Foundations of Chemistry I and CHEM 135 General Chemistry I (5) and
  CHEM 138 Foundations of Chemistry II and CHEM 135 General Chemistry II (5)
- PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4)
- CE 201 Statics (2)
- CE 300 Dynamics (3)
- CE 311 Strength of Materials (3)
- CE 330 Fluid Mechanics (4)
- CE 455 Hydrology (3)
- CE 487 Soil Mechanics (4)
- EECS 128 Foundations of Information Technology: _____ (3) or
  C&PE 121 Introduction to Computers in Engineering (3) or
  EECS 138 Introduction to Computing: _____ (3)

Geology 45-51 hours

- GEOL 101 Introduction to Geology (3) and
  GEOL 103 Geology Fundamentals Laboratory (2) or
  GEOL 105 History of the Earth (3)
- GEOL 311 Mineralogy and Structure of the Earth (3)
- GEOL 312 Mineral Structures and Equilibria Laboratory (1)
- GEOL 331 Sedimentology and Surface Processes (4)
- GEOL 351 Environmental Geology (3)
- GEOL 360 Field Investigation (2)
- GEOL 512 Igneous and Metamorphic Petrology (3)
- GEOL 513 Petrology Laboratory (1)
- GEOL 541 Geomorphology (4)
- GEOL 560 Introductory Field Geology (3)
- GEOL 561 Field Geology (3)
- GEOL 562 Structural Geology (4)
- GEOL 572 Geophysics (3) or
- GEOL 573 Geodynamics and Plate Tectonics (3)
- 3 additional geology or civil engineering courses, at least 2 of which must be from the following: (8-12)
  - GEOL 521 Paleontology (3)
  - GEOL 532 Stratigraphy (4)
  - GEOL 535 Petroleum and Subsurface Geology (4)
  - GEOL 715 Geochemistry (3)
  - GEOL 751 Physical and Transport Hydrogeology (4)
  - CE 770 Concepts of Environmental Chemistry (2) and
  - CE 771 Environmental Chemical Analysis (1)
  - Electives may include an upper-division course in statistics (MATH 365 or BIOL 570).

Note: Total credit hours may exceed the university's minimum requirement for graduation.

Environmental Geology Option

- Satisfaction of the College English requirement (6-9)
- COMS 130 Speaker-Audience Communication (3) or
- COMS 150 Personal Communication (3) (or exemption)
- 2 courses in the humanities (6-10)
- 2 courses in the social sciences (an introductory course in economics is recommended) (6-8)
- MATH 121 Calculus I (5) and MATH 122 Calculus II (5) (recommended) or
- MATH 115 Calculus I (3) and MATH 116 Calculus II (3) plus MATH 122 Calculus II (5)
- PHSX 211 General Physics I (4) and PHSX 212 General Physics II (4) (recommended) or
- PHSX 114 College Physics I (4) and PHSX 115 College Physics II (4)
- CHEM 181 Foundations of Chemistry I and
- CHEM 182 Foundations of Chemistry II
- BIOL 150 Principles of Molecular and Cellular Biology (4) and
- BIOL 152 Principles of Organismal Biology (4)
- EECS 128 Foundations of Information Technology: _____ (3) or
- EECS 138 Introduction to Computing: _____ (3) or
- C&PE 121 Introduction to Computers in Engineering (3)

Geology 50 hours

- GEOL 101 Introduction to Geology (3) and
- GEOL 103 Geology Fundamentals Laboratory (2)
- GEOL 311 Mineralogy and Structure of the Earth (3)
- GEOL 351 Environmental Geology (3)
- GEOL 360 Field Investigation (2)
- GEOL 521 Paleontology (3)
- GEOL 532 Stratigraphy (4)
- GEOL 541 Geomorphology (4)
- GEOL 552 Introduction to Hydrogeology (3)
- GEOL 560 Introductory Field Geology (3)
- GEOL 562 Structural Geology (4)
- GEOL 572 Geophysics (3)
- Additional courses to total at least 9 hours numbered 500 or above or other courses approved by adviser. Recommended: (9)
- GEOL 391 Special Studies in Geology: Water Resources (3)
Environmental Hydrogeology Track
Besides the general program above, a specialized track in hydrogeology satisfies degree requirements. In addition to College, supporting science, and geology courses, the environmental hydrogeology track requires the following mathematics and civil engineering/physics courses:

- **MATH 220** Applied Differential Equations (3) and **MATH 290** Elementary Linear Algebra (2)
- **CE 330** Fluid Mechanics (4) or **PHSX 623** Physics of Fluids (3)

**Technical Electives** (9 hours). These normally are chosen from courses numbered 500 or above in geology, physics, mathematics, chemistry, engineering or computer science. Courses numbered below 500 must be approved by a geology adviser.

Geophysics Option

College English and Principal Course Requirements 21 hours

- **ENGL 101**, **ENGL 102**, and a third course as specified by the College of Liberal Arts and Sciences (9)
- Courses in humanities and social sciences (12)
  (At least 3 hours must be taken in each area. View the principal course list. An introductory course in economics is recommended.)

Chemistry, Mathematics, Computer Science, Engineering 28-31 hours

- **EECS 138** Introduction to Computing: _____ (3) or demonstrate equivalent programming skills (0-3)
- **CHEM 184** Foundations of Chemistry I and **CHEM 130** General Chemistry I (5) and **CHEM 188** Foundations of Chemistry II and **CHEM 135** General Chemistry II (5)
- **MATH 121** Calculus I (5) and **MATH 122** Calculus II (5)
- **MATH 223** Vector Calculus (3) and **MATH 290** Elementary Linear Algebra (2)
- **MATH 320** Elementary Differential Equations (3)

Physics 17 hours

- **PHSX 211** General Physics I (4) and **PHSX 212** General Physics II (4)
- **PHSX 313** General Physics III (3)
- **PHSX 521** Mechanics I (3)
- **PHSX 531** Electricity and Magnetism (3)
Geology 33 hours
- **GEOL 101** Introduction to Geology (3) and
- **GEOL 103** Geology Fundamentals Laboratory (2)
- **GEOL 311** Mineralogy and Structure of the Earth (3)
- **GEOL 331** Sedimentology and Surface Processes (4)
- **GEOL 360** Field Investigation (2)
- **GEOL 512** Igneous and Metamorphic Petrology (3)
- **GEOL 560** Introductory Field Geology (3)
- **GEOL 562** Structural Geology (4)
- **GEOL 572** Geophysics (3) or
  - **GEOL 573** Geodynamics and Plate Tectonics (3)
- 2 of these 4 courses in addition to geology courses above: (6)
  - **GEOL 572** Geophysics (3)
  - **GEOL 573** Geodynamics and Plate Tectonics (3)
  - **GEOL 575** Seismic Exploration (3)
  - **GEOL 577** Environmental Geophysics (3)

**Technical Electives** (9 hours). These normally are chosen from courses numbered 500 or above in geology, physics, mathematics, chemistry, engineering, or computer science. Courses numbered below 500 must be approved by a geophysics adviser.

**Electives.** Additional credit hours of general electives are needed to meet the minimum total hours required for graduation.

**Graduation Requirements.** Students must earn a grade-point average of 2.0 in both physics and geology courses.

**Earth and Space Science Licensure Option**

This program fulfills the requirements for a Bachelor of Science degree in geology. The program also meets course requirements necessary to gain state licensure eligibility in earth and space science to become a secondary teacher in Kansas, but completion of the program does not guarantee the student’s licensure. This list is a guideline. Contact the geology department for further information about meeting degree and additional licensure requirements. You may also contact the UKanTeach Office for information about similar tracks resulting in eligibility for licensure in this and other science and mathematics fields.

**General Requirements 21 hours**

These courses must be taken on a letter-grade basis.

- **English:** **ENGL 101** Composition (3) and **ENGL 102** Critical Reading and Writing (3) (or equivalent)
- **Communication/Logic:** **COMS 130** Speaker-Audience Communication (3) or **COMS 150** Personal Communication (3) (or exemption/examination)
- **Humanities:** 1 principal course and **HIST 136** or **HIST 137** (or equivalent approved by geology department) (6)
- **Social Science:** 2 courses, preferably from the principal course list (6)

**Major/General Science Requirements 84 hours**

A minimum grade of C is required in all courses counted toward the major.
• Mathematics:
  MATH 121 Calculus I (5) and MATH 122 Calculus II (5) or
  MATH 115 Calculus I (3) and MATH 116 Calculus II (3) and MATH 122 Calculus II (5)
• Physics:
  PHSX 211 General Physics I (4) and
  PHSX 212 General Physics II (4)
• Chemistry:
  CHEM 184 130 (or CHEM 185 190) Foundations of General Chemistry I (5) and
  CHEM 188 135 (or CHEM 189 195) Foundations of General Chemistry II (5)
• Biology:
  BIOL 150 (or BIOL 151 Honors) Principles of Molecular and Cellular Biology (4) and
  BIOL 152 (or BIOL 153 Honors) Principles of Organismal Biology (4)
• Geology Core Requirements (32 hours):
  GEOL 101 Introduction to Geology (3) and
  GEOL 103 Geology Fundamentals Laboratory (2)
  GEOL 311 Mineralogy and Structure of the Earth (3)
  GEOL 331 Sedimentology and Surface Processes (4)
  GEOL 360 Field investigation (2)
  GEOL 521 Paleontology (3) and
  GEOL 523 Paleontology Laboratory (1)
  GEOL 532 Stratigraphy (4)
  GEOL 552 Introduction to Hydrogeology (3)
  GEOL 560 Introductory Field Geology (3)
  GEOL 562 Structural Geology (4)
  Space Science Core Requirements (9 hours):
  ATMO 105 Introductory Meteorology (5)
  ASTR 191 Contemporary Astronomy (3)
  ASTR 196 Introductory Astronomy Laboratory (1)
• Earth and Space Electives: 4 hours in a geology course numbered 300 or above (4) or
  4 hours in astronomy courses numbered 300 or above. This can include 3 hours of ASTR 390 or
  GEOL 399, GEOL 105, GEOL 304, or GEOL 121 also can count if taken before the student has
  completed 60 hours (4)
• Research Methods: CHEM 598 Research Methods (3)
  (or equivalent course approved by geology in major field of study)

Professional Development Course Work Requirements 21 hours
A minimum grade of C is required in all courses.

• Liberal Arts and Sciences:
  LA&S 290 Approaches to Teaching Science and Mathematics I (1) and
  LA&S 291 Approaches to Teaching Science and Mathematics II (1)
• Curriculum and Teaching (19 hours):
  C&T 448 Reading and Writing across the Curriculum (3) and
  16 hours of courses approved by UKanTeach in curriculum and teaching. These should include
  courses such as Classroom Interactions (3), Knowing and Learning (3), Project Based Instruction (3),
  Student Teaching (6), and Special Topics Seminar (1)

Requirements for the B.S. Degree Mathematics

First- and Second-Year Preparation 18 hours
• MATH 121 Calculus I (5) or 
  MATH 141 Calculus I, Honors (5)
• MATH 122 Calculus II (5) or 
  MATH 142 Calculus II, Honors (5)
• MATH 223 Vector Calculus (3) or 
  MATH 243 Vector Calculus, Honors (3)
• MATH 290 Elementary Linear Algebra (2) or 
  MATH 291 Elementary Linear Algebra, Honors (2)
• MATH 320 Elementary Differential Equations (3) or 
  MATH 220 Applied Differential Equations (3)

Core Requirements 12-13 hours
• Linear Algebra: MATH 590 Linear Algebra (3) or 
  MATH 790 Linear Algebra II (3)
• Analysis: MATH 500 Intermediate Analysis (3) or 
  MATH 765 Mathematical Analysis I (3)
• Algebra: MATH 558 Introductory Modern Algebra (3) or 
  MATH 791 Modern Algebra (3)
• Statistics: MATH 526 Applied Mathematical Statistics I (3) or 
  MATH 628 Mathematical Theory of Statistics (3) or 
  MATH 728 Statistical Theory (3) or DSCI 301 Statistics (4)

Mathematics Concentration/Sequence Requirements 6-12 hours
• One 2-course sequence from List A and a second 2-course sequence from either List A or List B

Electives 0-6 hours
• Up to 2 additional 3-credit-hour courses to complete a total of 24 credit hours of mathematics courses numbered MATH 450 and above. Students who satisfy the core statistics requirement with DSCI 301 must choose an additional 3-credit-hour elective.

Applied Concentration 8 hours
• 3 courses, totaling at least 8 credit hours, that make significant use of mathematics. At least 2 courses must be in the same area. Courses from List C have been approved for this requirement. Other upper-division courses making significant use of mathematics can be used for the applied concentration with the approval of a mathematics department adviser.

Note: Many of these courses have prerequisites that do not count toward the mathematics major.

Minimum Major Requirements 42 hours
Applied Concentration 8 hours

General Education Requirements 49-49 hours
• English, Argument and Reason, and Western Civilization (18)(These are the same as the requirements for the B.A. degree.)
• Computer Science: EECS 138 (3) or EECS 168 (4)
• Natural Science: 1 course with laboratory (4-5 hours) and one additional course (3-5 hours) in biological science (NB), earth science (NE), or physical science (NP) (7-10)
• Humanities and Foreign Language: 4 courses in humanities and foreign language, at least two (6 hours) of which must be in humanities (designated H). Students are encouraged to complete at least two courses in a foreign language (12)
• Social Sciences: 2 courses designated S (6)
List A Sequences

- MATH 627 Probability (3) and MATH 628 Mathematical Theory of Statistics (3)
- MATH 660 Geometry I (3) and MATH 661 Geometry II (3)
- MATH 765 Mathematical Analysis I (3) and MATH 766 Mathematical Analysis II (3)
- MATH 781 Numerical Analysis I (3) and MATH 782 Numerical Analysis II (3)
- MATH 790 Linear Algebra II (3) and MATH 791 Modern Algebra (3)

List B Sequences

- MATH 500 Intermediate Analysis (3) and MATH 646 Complex Variable and Applications (3)
- MATH 526 Applied Mathematical Statistics I (3) and MATH 605 Applied Regression Analysis (3)
- MATH 526 Applied Mathematical Statistics I (3) and MATH 611 Time Series Analysis (3)
- MATH 530 Mathematical Models I (3) and MATH 531 Mathematical Models II (3)
- MATH 540 Elementary Number Theory (3) and MATH 558 Introductory Modern Algebra (3)
- MATH 558 Introductory Modern Algebra (3) and MATH 601 Algebraic Coding Theory (3)
- MATH 581 Numerical Methods (3) and MATH 591 Applied Numerical Linear Algebra (3)
- MATH 590 Linear Algebra (3) and MATH 790 Linear Algebra II (3)
- MATH 646 Complex Variable and Applications (3) and MATH 647 Applied Partial Differential Equations (3)
- MATH 647 Applied Partial Differential Equations (3) and MATH 648 Calculus of Variations and Integral Equations (3)
- MATH 724 Combinatorial Mathematics (3) and MATH 725 Graph Theory (3)

List C Applied Concentration Courses

- Statistics: MATH 605, MATH 611, MATH 624, ECON 817, ECON 818
- Management Science and Operations Management: SCM 310, DSCI 410
- Finance: FIN 310, FIN 410, FIN 415, FIN 420, FIN 425, MATH 630
- Economics: ECON 526, ECON 590, ECON 700, ECON 701, ECON 715, ECON 716
- Biology: BIOL 350, BIOL 412, BINF 701, BINF 702, BIOL 743, BIOL 747
- Physics and Astronomy: PHSX 313, PHSX 521, PHSX 531, ASTR 591, ASTR 592, PHSX 621, PHSX 631, PHSX 655, PHSX 671, ASTR 691, PHSX 741
- Chemistry: CHEM 516, CHEM 646, CHEM 648
- Bioinformatics: BINF 701, BINF 702
- Chemical and Petroleum Engineering: C&PE 211, C&PE 511, C&PE 521, C&PE 523
- Civil Engineering: CE 201, CE 300, CE 301, CE 310, CE 311, CE 461, CE 704
- Electrical Engineering and Computer Science: EECS 211, EECS 220, EECS 360, EECS 420, EECS 444, EECS 510, EECS 560, EECS 562, EECS 638, EECS 649, EECS 660, EECS 662, EECS 672, EECS 718, EECS 730, EECS 744
- Mechanical Engineering: ME 201, ME 311, ME 312, ME 321, ME 508, ME 520, ME 612, ME 682, ME 740

Note: Some courses satisfying the sequence requirements are taught infrequently. More advanced courses can be substituted for lower level courses in many cases. Consult the mathematics department for expected course offerings and substitutions.

Courses used to satisfy the core requirements can also be used to complete List A and List B sequences. However, courses used for the Applied Concentration requirement cannot also be counted toward the 24 credit hours of advanced mathematics courses for the B.S. degree.

Requirements for the B.A. Major in Physics
Foundational Physics and Mathematics 1805 hours

- PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics (0.5)
- PHSX 211 (or PHSX 213) General Physics I (4)
- PHSX 212 (or PHSX 214) General Physics II (4)
- MATH 121 Calculus I (5) and
  MATH 122 Calculus II (5)

CHEM 184 130 is recommended. Some courses require MATH 223 and MATH 290 and MATH 220 or MATH 320 as prerequisites. Other requirements follow the general education requirements for B.A. degrees in the College of Liberal Arts and Sciences.

Advanced Physics Courses 20 hours

- PHSX 313 General Physics III (3) and
  PHSX 316 Intermediate Physics Laboratory I (1)
- PHSX 511 Introductory Quantum Mechanics (3)
- PHSX 521 Mechanics I (3)
- PHSX 531 Electricity and Magnetism (3)
- PHSX 536 Electronic Circuit Measurement and Design (4)
- Advanced physics elective (any lecture or laboratory course numbered 500 or higher) (3)

Concentration in Computational Physics

Requirements include 31.5 hours in physics:

- PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics (0.5)
- PHSX 211 (or PHSX 213) General Physics I (4)
- PHSX 212 (or PHSX 214) General Physics II (4)
- PHSX 313 General Physics III (3) and
  PHSX 316 Intermediate Physics Laboratory (1)
- PHSX 521 Mechanics I (3)
- PHSX 531 Electricity and Magnetism (3)
- PHSX 536 Electronic Circuit Measurement and Design (4)
- PHSX 500 (or PHSX 501) Special Problems (6)
- PHSX 615 Numerical and Computational Methods in Physics (3)

Also required are 8 hours of computer science (EECS 168, EECS 268), MATH 290 and either MATH 220 or MATH 320, CHEM 184 130 (5 hours), PHIL 310 (3 hours), ECON 142 or ECON 144 (3 hours), and BIOL 100 (3 hours). CHEM 184 130, PHIL 310, ECON 142 or ECON 144, and BIOL 100 should be taken to fulfill B.A. general education requirements.

Requirements for the B.S. Degree in Physics

2 different options are available for the physics B.S. curriculum. The pre-professional emphasis offers a rigorous curriculum suitable for students planning on graduate study in physics or a closely related field; the interdisciplinary option provides more flexibility for students interested in developing some expertise in an allied science discipline.

General Requirements

- EECS 138 Introduction to Computing: FORTRAN or C++ (3) or
  EECS 168 Programming I (4)
• **English:** Satisfaction of B.A. requirements. If requirements can be satisfied in fewer than 9 hours, the remaining hours become free electives. (*ENGL 362 Foundations of Technical Writing is accepted as the third English course.*) (9)

  - Western civilization (6)
  - **Humanities:** 2 courses including at least one principal course (6)
  - **Social sciences:** 2 courses including at least one principal course (6)

Additional credit hours of general electives are needed to meet the minimum total hours required for graduation. Approximately 5 free elective hours must be taken at the junior/senior level to fulfill the requirement of 45 junior/senior hours.

**Foundational Physics and Mathematics 23.5 hours**

- PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics (0.5)
- PHSX 211 (or PHSX 213) General Physics I (4)
- PHSX 212 (or PHSX 214) General Physics II (4)
- MATH 121 Calculus I (5) and MATH 122 Calculus II (5)
- CHEM 184 Foundations of General Chemistry I (5)

**Advanced Mathematics 11 hours**

- MATH 223 Vector Calculus (3) and MATH 290 Elementary Linear Algebra (2)
- MATH 320 Elementary Differential Equations (3)
- MATH elective (3) (This may be chosen from PHSX 518, PHSX 718, MATH 526, MATH 530, MATH 558, MATH 581, MATH 590, MATH 628, MATH 646, MATH 647, MATH 648, MATH 660, MATH 661, or any 700-level MATH lecture course except MATH 701 and MATH 715.)

**Advanced Physics Core for Both B.S. Emphases 24 hours**

- PHSX 313 General Physics III (3) and PHSX 316 Intermediate Physics Laboratory I (1)
- PHSX 511 Introductory Quantum Mechanics (3)
- PHSX 516 Physical Measurements (4) or PHSX 536 Electronic Circuit Measurement and Design (4)
- PHSX 521 Mechanics I (3)
- PHSX 531 Electricity and Magnetism (3)
- PHSX 671 Thermal Physics (3)
- PHSX 503 Undergraduate Research (1) or PHSX 501 Honors Research (1)
- PHSX elective (3) (any PHSX lecture or laboratory course numbered 500 or higher and not part of the other specific requirements for the major)

**Preprofessional Emphasis**

Students also take 13 credit hours in physics as follows:

- PHSX 621 Mechanics II (3)
- PHSX 631 Electromagnetic Theory (3)
- PHSX 711 Quantum Mechanics (3)
• **PHSX 516** Physical Measurements (4) or
  **PHSX 536** Electronic Circuit Measurement and Design (4) (Preprofessional emphasis students take both advanced laboratory courses)

**Interdisciplinary Option**

Students also take 12 to 15 credit hours in physics and allied sciences as follows:

2 of the following: (6-7)

- **PHSX 621** Mechanics II (3)
- **PHSX 631** Electromagnetic Theory (3)
- **PHSX 711** Quantum Mechanics (3)
- **PHSX 516** Physical Measurements (4) or
  **PHSX 536** Electronic Circuit Measurement and Design (4) (Interdisciplinary option students may take the second advanced laboratory courses)

Plus 2 semesters of advanced course work in 1 allied science field chosen from the following: (6-8)

- **BIOL 350** Principles of Genetics (3)
- **BIOL 400** Fundamentals of Microbiology (3)
- **BIOL 408** Physiology of Organisms (3)
- **BIOL 412** Evolutionary Biology (3)
- **BIOL 416** Cell Structure and Function (3)
- **BIOL 600** Introductory Biochemistry, Lectures (3)
- **BIOL 636** Biochemistry I (3)
- **BIOL 638** Biochemistry II (3)
- **CHEM 598** Research Methods (3) (UKanTeach students only)
- **CHEM 622** Fundamentals of Organic Chemistry (3)
- **CHEM 646** Physical Chemistry I (3)
- **GEOL 360** Field Investigation (2)
- **GEOL 562** Structural Geology (4)
- **GEOL 572** Geophysics (3)
- **GEOL 575** Seismic Exploration (3)
- **GEOL 576** Potential Fields Exploration (3)
- **GEOL 577** Environmental Geophysics (3)

**Requirements for the B.S. Behavioral Neuroscience Degree**

**Requirements for the B.S. Degree**

**B.S. in Behavioral Neuroscience**

**Nonpsychology General Education Courses**

A total of 84 hours with classes in these 4 areas and additional electives:

**Humanities 24 hours**

- *English*: **ENGL 101** and **ENGL 102** (6) and
  **ENGL 203**, **ENGL 205**, **ENGL 209**, **ENGL 210**, or **ENGL 211** (3)
- *Argument and Reason*: **COMS 130** or **PHIL 148** (3)
- *Western Civilization*: **HWC 204-HWC 205** (6)
- *Humanities*: 2 electives (6)
Natural Sciences 14 hours minimum
2 of the following 4 sequences, an extension of 1, or an approved alternative.

- **Biology**: BIOL 150 and BIOL 152 (8)
- **Chemistry**: CHEM 184 130 and CHEM 488 135 (10)
- **Physics**: PHSX 114 and PHSX 115 (8)
- **Biological Anthropology**: ANTH 104/ANTH 304 and ANTH 340, ANTH 341, ANTH 350, ANTH 442, or ANTH 447 (6)

Mathematics 12 hours minimum
6 hours must be calculus or calculus based.

- **MATH 103** (2)
- **MATH 115 and MATH 116** (6)
- One additional MATH course (3)

Computing 6 hours minimum

- **EECS 138 Introduction to Computing: _____** (3)
- The second 3 hours could either be a second semester of EECS 138 (focused on a second programming language) or be from an additional approved course that provides an opportunity to gain computing experience. This second course could be PSYC 480 or PSYC 481 if this Independent Study requires independent, original application of the student’s computing skills such as computer simulation of cognitive processes, or experience with computationally complex neuroscience techniques, such as brain imaging and mapping, or physiological data collection and analysis. (3)

Behavioral Neuroscience

**Required Psychology Courses.** A total of at least 40 hours with classes in these 4 areas (28 hours), and additional junior/senior-level psychology electives or approved neuroscience-related courses (12 hours).

**Behavioral Neuroscience Courses 6 hours total**

- **PSYC 370/PSYC 371** Brain and Behavior (3)
- **PSYC 380/PSYC 381** Brain and Pathology (3)
- **PSYC 644** Behavioral Pharmacology (3)

**Laboratory Courses 9 hours total**

- **PSYC 200/PSYC 201** Research Methods in Psychology (3)
- **PSYC 625** Experimental Psychology: Methods in Neuropsychology and Psychophysiology (6)

Quantitative Courses 9 hours minimum

- **PSYC 210/PSYC 211** Statistics in Psychological Research (3)
- **PSYC 500** Intermediate Statistics in Psychological Research (3)
- **PSYC 650** Statistical Methods in Behavioral and Social Science Research I (4)
- **PSYC 651** Anova and Other Factorial Designs (4)
- **PSYC 679** Applied Nonparametric Statistical Methods (4)
- **PSYC 687** Factor Analysis (4)
- PSYC 692 Test Theory (4)
- PSYC 693 Multivariate Analysis (4)
- PSYC 694 Multilevel Modeling I (4)
- PSYC 695 Categorical Data Analysis (4)
- PSYC 696 Structural Equation Modeling I (4)

**Applied Research Experience 4 hours minimum**
- PSYC 449 Laboratory/Field Work in Human Biology
- PSYC 460 Honors in Psychology
- PSYC 480 Independent Study
- PSYC 481 Research Practicum

**Elective Courses in Psychology or Other Disciplines 12 hours minimum (other electives may be accepted with permission of the B.S. director)**
- PSYC 418 Introduction to Cognitive Science (3)
- PSYC 432 Human Behavioral Genetics (3)
- PSYC 482 Sensation and Perception (3)
- PSYC 555 Evolutionary Psychology (3)
- PSYC 605 Health Psychology (3)
- PSYC 630 Clinical Psychology (3)
- PSYC 646 Mental Health and Aging (3)
- PSYC 678 Drugs and Behavior (3)
- LING 438 Neurolinguistics (3)
- SPLH 320 Introduction to the Neuroscience of Human Communication (2)

**Requirements for the Minor in Astrobiology**

Preparatory course work should include calculus (MATH 121 or MATH 116, with MATH 121 preferred) and CHEM 184. Additional credit hours in astronomy, biology, chemistry, geology, or physics (ABCGP) are required as follows:

- BIOL 150 Principles of Molecular and Cellular Biology (4)
- GEOL 101 Introduction to Geology (3) or
  GEOL 105 History of the Earth (3) or
  GEOL 121 Prehistoric Life: DNA to Dinosaurs (3)
- ASTR 391 Physical Astronomy, Honors (3)
- ASTR 394 The Quest for Extraterrestrial Life (3) or
  3 credit hours of undergraduate research in astrobiology (3)
- 6 credit hours of course work in ABCGP at the 300-level or higher and not in the student's major field (6)

d. **Proposal for a changes for selecting BGS Liberal Arts and Science Degree option**

**Proposal:**
Change the requirements for officially selecting the BGS LA&S degree option so that students can access the correct ARTS/DPR information sooner in their academic career.

**Declaration of BGS Non-major Degree Option**
**Administrative Requirements**
The following requirements have been developed to encourage:

1. Satisfactory completion of all Math and English General Education Requirements.
Courses:
ENGL 101, 102, and 3rd English (ENGL 203, 205, 209, 210, or 211)
MATH 002 (if required), 101, and 2nd Math (MATH 105, 106, 111, 115, 121, 141, 365, or BIOL 570)
Rationale: To encourage a strong foundation of basic skills early in the curriculum.

2. Satisfactory completion of courses from 15 departments in the College of Liberal Arts and Sciences.
   Rationale: To encourage full exploration of potential major/area of interest.

3. Good Academic Standing, KU cumulative GPA of 2.0 or better.
   Rationale: To maintain advising support for students in academic difficulty.

Proposed
Declaration of BGS Non-major Degree Option
Administrative Requirements
The following requirements have been developed to encourage:

1. Satisfactory completion of all Math and English General Education Requirements.
   Courses:
   ENGL 101, 102, and 3rd English (ENGL 203, 205, 209, 210, or 211)
   MATH 002 (if required), 101, and 2nd Math (MATH 105, 106, 111, 115, 121, 141, 365, or BIOL 570)
   Rationale: To encourage a strong foundation of basic skills early in the curriculum.

2. Satisfactory completion of courses from 10 departments in the College of Liberal Arts and Sciences, or junior status.
   Rationale: To encourage full exploration of potential major/area of interest.

3. Good Academic Standing, KU cumulative GPA of 2.0 or better.
   Rationale: To maintain advising support for students in academic difficulty.

Justification:
The “admission” requirements for this option are the same as the ultimate completion requirements (completion of courses from 15 departments in CLAS). Typically completion of the 15 department exploration requirement is the final outstanding area requirement, so students are never allowed to select the program/plan code for the option they are pursuing, and are not able to easily access the requirements for this option via their ARTS form or DPR. This causes problems for students who are trying to apply to graduate, as they cannot apply for a program/plan code that is not yet listed in Enroll & Pay, and they are not allowed to list it until after completion of all 15 department courses. Further, students list an incorrect major code for their program/plan in order to avoid the non-declared hold because they cannot select the BGS LA&S code.