

emphasizes microbial structure, function, and interactions and relationships with humans. The microbial ecology option emphasizes microbial structure, function, and interactions and relationships with the environment and other organisms.

The Division also offers a Bachelor's degree in **Medical Technology** (Michael Minnick, Professor of Microbiology, Advisor). **Medical Technology** or clinical laboratory science is a combined study of chemistry, physiology and microbiology (<http://www.umt.edu/medtech/>). A medical technologist performs chemical, microscopic, and microbiological procedures used in the diagnosis, study and treatment of disease. Medical technologists are in high demand in hospital labs, clinical labs, research institutions and government health departments. Certification is required for clinical practice.

To be certified by the Board of Registry, a student, after satisfying the minimum course requirements, serves a clinical practicum of at least 12 consecutive months in an approved school of medical technology endorsed by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) or American Society of Clinical Pathology (ASCP) of the American Medical Association. After completing a clinical practicum and passing the Registry exam, the student receives a diploma from the Board of Registry with the professional designation of Medical Technologist M.T. ASCP.

The University of Montana has two coursework options for the medical technology degree. The 3+1 track includes the practicum at one of our affiliated programs as part of the degree, while the practicum is not included in the 4+1 track.

Degree requirements for all three majors and courses are described below (see the College of Forestry and Conservation for information about Wildlife Biology and the Biochemistry Program in the College of Humanities and Sciences for information about Biochemistry).

The Division of Biological Sciences is committed to providing coursework and experiences for non-science majors. The world faces many problems and opportunities that include significant biological components. Courses for non-science majors have the goal of fostering understanding of the process of science and enhancing biological knowledge as it relates to environmental, medical, social, and other issues. A number of introductory courses are open both to majors and non-majors. In addition, the Division offers courses designed specifically for non-majors: Microbiology for Health Sciences, Introductory Ecology, Survey of Montana Wildlife and Habitats, and others.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: Major Subject: Biology Option: **Biological Education**

Total Credits: 62 Cumulative GPA Required: 2.75

Individuals interested in teaching in K-12 schools must complete a degree in the content area they want to teach plus the teacher preparation program through the Department of Curriculum and Instruction. Individuals

must complete the teaching major/teaching track within that degree program, which may contain different course requirements than the academic major since the sequence of courses is designed to meet state standards. Upon completion of the degree program with the teaching track and the secondary licensure program, one will be eligible for a standard Montana teaching license in this content area.

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing		Number of Credits	17	
BIOB 160N	Principles of Living Systems	4		F,SU
BIOB 170N	Princpls Biological Diversity	3		S,SU
BIOB 171N	Princpls Biological Dvrsty Lab	2		S,SU
BIOB 260	Cellular and Molecular Biology	4		F,SU
BIOB 272	Genetics and Evolution	4		S,SU

Commentary: The lower division core should be completed before attempting most upper division major courses. AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Commentary: Upper Division Core

Category Name: Upper Division Core Courses Required by the Biological Education Option

Rule: All of the following courses are required.

Criterion: C-

Course Listing		Number of Credits	14	
BIOE 370	General Ecology	3		F
BIOE 371	Gen Ecology Lab (equiv to 271)	2		F
BIOM 360	Gen Microbiolgy (equiv to 260)	3		F,S
BIOM 361	Gen Microbiolgy Lb (equiv 261)	2		F,S
BIOO 433	Plant Physiology	3		S
BIOO 434	Plant Physiology Lab	1		S

Commentary: Major Electives

Rule: Complete one of the following courses

Criterion: C- Number of Credits 3

Course Listing

BIOB 301	Developmental Biology	3		S
BIOL 435	Comparative Animal Physiology	3		S

Commentary: Cognates

Category Name: Required Content Courses Outside of the Major Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics - Calculus

Rule: Complete one of the following calculus courses

Criterion: C- Number of Credits 4

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: Choose M 171, if you plan to take additional calculus courses, or if you plan a double major or minor in a field that requires more calculus (e.g. math, physics, biochemistry, computer science).

Subcategory Name: Mathematics - Statistics Rule: The following course is required

Criterion: C- Number of Credits 4

Course Listing

STAT 216 Introduction to Statistics 4 F,S,SU Commentary:

Subcategory Name: Chemistry

Rule: All of the following courses are required

Criterion: C- Number of Credits 9

Course Listing

CHMY 121N Intro to General Chemistry 3 F,S,SU

CHMY 123N Intro to Organic & Biochem 3 F,S,SU

CHMY 124N Intro to Organic & Biochem Lab 2 F,S,SU

CHMY 485 Laboratory Safety 1 F

Commentary: CHMY 141N, 143N, 123N (required for the general science broadfield teaching option) will substitute for CHMY 121N, 123N/124N.

Subcategory Name: Physics

Rule: All of the following courses are required

Criterion: C- Number of Credits 5

Course Listing

PHSX 205N College Physics I 4 F,S,SU

PHSX 206N College Physics I Laboratory 1 F,S,SU

Commentary: These are algebra- and trigonometry-based physics courses. The calculus-based physics courses, PHSX 215N/216N (which require M 171), may be substituted for PHSX 205N/206N.

Subcategory Name: Environmental Geosciences Rule: Complete one of the following courses

Criterion: C- Number of Credits 3

Course Listing

GEO 105N Oceanography 3 S

GEO 108N Climate Change 3 F

Commentary:

Subcategory Name: Education

Rule: The following course is required

Criterion: C- Number of Credits 3

Course Listing

EDU 497 Teaching and Assessing Reading 0 To 4 F

Commentary: The course number EDU 497 covers many different teaching method courses. The section of EDU 497 entitled "Methods: 5 - 12 Science" is required for the Biological Education option.

Commentary:

Upper Division Writing

Category Name: Upper Division Writing Expectation for the Major

Rule: Complete the equivalent of a full writing course (either three 1/3 writing courses or one 2/3 writing course + one 1/3 writing course or one complete writing course)

Criterion: C- Number of Credits

Course Listing

Commentary: To meet the Upper Division Writing Expectation for the Major, Biology students take 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Biological Education Option requires one 2/3 writing course (BIOE 371) and one 1/3 writing course (BIOO 434). No additional courses are needed to meet this requirement.

Subcategory Name: 1/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 482	Advanced Biochemistry II	3	S
BIOB 425	Adv Cell & Molecular Biology	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOE 403	Vert Design & Evolution	5	F
BIOE 409	Behavior & Evolution Discussion	1	
BIOE 428	Freshwater Ecology	5	F
BIOL 484	Plant Evolution	3	I
BIOM 402	Medical Bacteriology & Mycology	3	S
BIOO 320	General Botany	5	F
BIOO 434	Plant Physiology Lab	1	S
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary:

Subcategory Name: 2/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 486	Biochemistry Research Lab	3	S
BCH 499	Senior Thesis/Capstone	3 To 6	F,S,SU
BIOB 411	Immunology Laboratory	2	F
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU
BIOE 342	Field Ecology	5	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F
BIOM 411	Exprmntl Microbial Genetcs Lab	1	

BIOM 499 Undergraduate Thesis 3 To 6 F,S,SU

Commentary:

Subcategory Name: Complete UD Writing Course Rule:

Criterion: Number of Credits

Course Listing

BIOH 462 Principles Medical Physiology 3

Commentary:

Commentary: Additional Requirements

Category Name: Secondary Teaching Licensure

teaching licensure (see the College of Education & Human Sciences) Degree Specific Symbolic Systems

Category Name: Exception to the Modern/Classical Languages Requirement Rule: Choose one of the following Math courses

Criterion: C- Number of Credits

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: The Division of Biological Sciences has been granted an exception to the Modern/Classical Language Requirement. Either of these Calculus courses (required by the major) will satisfy this requirement.

Commentary: Degree Commentary

This option provides students with coursework in biology and related science and mathematics needed to be certified by the State of Montana to teach secondary biology (in middle and high school). This option is appropriate for students interested in teaching biology in a larger, more urban school. In order to be licensed to teach secondary biology, students must be admitted to the Teacher Education Program through the Phyllis J. Washington College of Education and Human Sciences.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: **Major** Subject: **Biology** Option: **Cellular & Molecular Biology**

Total Credits: 81 Cumulative GPA Required: 2.0

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing Number of Credits 17

BIOB 160N Principles of Living Systems 4 F,SU

BIOB 170N Princpls Biological Diversity 3 S,SU

BIOB 171N Princpls Biological Dvrsty Lab 2 S,SU

BIOB 260 Cellular and Molecular Biology 4 F,SU

BIOB 272 Genetics and Evolution 4 S,SU

Commentary: The lower division core should be completed before attempting most upper division major courses. AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Commentary: Upper Division Core

Category Name: Upper Division Core Courses Required by Cellular & Molecular Biology option

Rule: All of the following courses are required.

Criterion: C-

Course Listing		Number of Credits	20	
BCH 480	Advanced Biochemistry I	3		F
BCH 482	Advanced Biochemistry II	3		S
BIOB 301	Developmental Biology	3		S
BIOB 375	General Genetics	3		S
BIOB 425	Adv Cell & Molecular Biology	3		S
BIOM 360	Gen Microbiology (equiv to 260)	3		F,S
BIOM 361	Gen Microbiology Lb (equiv 261)	2		F,S

Commentary: Major Electives

Category Name: Additional UD Major Courses Required for the Cellular & Molecular Biology Option Rule:

Complete one or two courses in each subcategory (as indicated)

Criterion: C- Number of Credits

Course Listing

Subcategory Name: Disease Elective

Rule: Complete at least one of the following courses

Criterion: C- Number of Credits 3

Course Listing

BIOB 410	Immunology	3		F
BIOM 435	Virology	3		S

Subcategory Name: Additional UD Depth Courses (Lecture) Rule: Complete at least one of the following lecture courses

Criterion: C-

Course Listing

Course Listing		Number of Credits	2-4	
BIOB 440	Biological Electron Microscopy	2		S
BIOB 468	Endocrinology 3			I
BIOB 483	Phylogenetics and Evolution	3		
BIOB 486	Genomics	3		F
BIOL 435	Comparative Animal Physiology	3		S
BIOM 410	Microbial Genetics	3		S
BIOM 450	Microbial Physiology	3		F
BIOO 433	Plant Physiology	3		S

Commentary: If BIOO 433, then the lab BIOO 434 must also be taken.

Subcategory Name: Additional UD Depth Courses (Laboratory) Rule: Complete at least two of the following laboratory courses

Criterion: C- Number of Credits 2-5

Course Listing

BCH 486	Biochemistry Research Lab	3	S	
BIOB 411	Immunology Laboratory	2	F	
BIOM 411	Exprmntl Microbial Genetcs Lab	1	S	
BIOM 451	Microbial Physiology Lab	1	F	
BIOM 490	Adv Undergrad Research	1 To 10	F,S,SU	

Commentary: Cognates

Category Name: Required Courses Outside of the Major Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics - Calculus Rule: Required

Criterion: C- Number of Credits 4

Course Listing

M 162	Applied Calculus	4	F,S	
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Commentary: M 171 Calculus I may be substituted for M 162.

Subcategory Name: Chemistry

Rule: All of the following courses are required.

Criterion: C- Number of Credits 20

Course Listing

CHMY 141N	College Chemistry I	5	F,S	
CHMY 143N	College Chemistry II	5	S,SU	
CHMY 221	Organic Chem I	3	F	
CHMY 222	Org Chm I Lab	2	F	
CHMY 223	Organic Chm II	3	S	
CHMY 224	Org Chm II Lab	2	S	

Commentary:

Subcategory Name: Additional Depth in Chemistry

Rule: Complete at least one of the following chemistry courses

Criterion: C- Number of Credits 3 or 4

Course Listing

CHMY 311	Analytical Chem-Quant Analysis	4	F,SU	
CHMY 360	Applied Physical Chemistry	3	S	
CHMY 373	Phys Chem-Kntcs & Thrmdynmcs	4	F	

Commentary:

Subcategory Name: Physics

Rule: All of the following courses are required.

Criterion: C- Number of Credits 10

Course Listing

PHSX 205N	College Physics I	4	F,S,SU	
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PHSX 206N College Physics I Laboratory 1 F,S,SU

PHSX 207N College Physics II 4 F,S,SU

PHSX 208N College Physics II Laboratory1 F,S,SU

Commentary: These are algebra- and trigonometry-based physics courses. The calculus-based physics sequence, PHSX 215N/216N & PHSX 217N/218N (which require M 171 and M 172), may be substituted for PHSX 205N/206N & 207N/208N.

Commentary:

Upper Division Writing

Category Name: Upper Division Writing Expectation for the Major

Rule: Complete the equivalent of a full writing course (either three 1/3 writing courses or one 2/3 writing course + one 1/3 writing course or one complete writing course)

Criterion: C- Number of Credits

Course Listing

Commentary: To meet the Upper Division Writing Expectation for the Major, Biology students take 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Cellular & Molecular Biology Option requires two 1/3 writing courses: BCH 482 and BIOB 425. The UD Writing Expectation for the Major is completed with one additional course, chosen from any of the following.

Subcategory Name: 1/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 482	Advanced Biochemistry II	3	S
BIOB 410	Immunology	3	F
BIOB 425	Adv Cell & Molecular Biology	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOE 403	Vert Design & Evolution	5	F
BIOE 409	Behavior & EvolutionDiscussion	1	
BIOE 428	Freshwater Ecology	5	F
BIOL 484	Plant Evolution	3	I
BIOM 402	Medical Bacteriology& Mycology	3	S
BIOO 320	General Botany	5	F
BIOO 434	Plant Physiology Lab	1	S
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary:

Subcategory Name: 2/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 486	Biochemistry Research Lab	3	S
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BCH 499	Senior Thesis/Capstone	3 To 6	F,S,SU
BIOB 411	Immunology Laboratory	2	F
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU
BIOE 342	Field Ecology	5	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F
BIOM 411	Exprmntl Microbial Genetcs Lab	1	
BIOM 499	Undergraduate Thesis	3 To 6	F,S,SU

Commentary:

Subcategory Name: Complete UD Writing Course Rule:

Criterion: C- Number of Credits

Course Listing

BIOH 462	Principles Medical Physiology	3	
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Commentary:

Degree Specific Symbolic Systems

Category Name: Exception to the Modern/Classical Languages Requirement Rule: Choose one of the following Math courses

Criterion: C- Number of Credits

Course Listing

M 162	Applied Calculus	4	F,S
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M 171	Calculus I	4	F,S
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Commentary: The Division of Biological Sciences has been granted an exception to the Modern/Classical Language Requirement. Either of these Calculus courses (required by the major) will satisfy this requirement.

Degree Commentary: Cellular and molecular biology is the study of cellular, molecular, and physiological aspects of biology. This option is a graduate prep program, and is for students interested in academia or research jobs in private or government laboratories. It is also an excellent option for pre-medical sciences students.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: **Major** Subject: **Biology** Option: **Ecology and Organismal Biology**

Total Credits: 69 Cumulative GPA Required: 2.0

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing Number of Credits 17

BIOB 160N	Principles of Living Systems	4	F,SU
BIOB 170N	Princpls Biological Diversity	3	S,SU
BIOB 171N	Princpls Biological Dvrsty Lab	2	S,SU
BIOB 260	Cellular and Molecular Biology	4	F,SU
BIOB 272	Genetics and Evolution	4	S,SU

Commentary: The lower division core should be completed before attempting most upper division major courses. AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Commentary: Upper Division Core

Category Name: Upper Division Core Courses Required by Ecology & Organismal Biology Option

Rule: All of the following courses are required.

Criterion: C- Number of Credits 5

Course Listing

BIOE 370	General Ecology	3	F
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F

Commentary: BIOE 342 Field Ecology at the Flathead Lake Biological Station may be substituted for BIOE 370/371

Major Electives

Category Name: Additional Upper Division Major Courses Required for the Ecology & Organismal Biology Option

Rule: Complete a minimum of 21 credits of UD BIOB, BIOE, BIOH, BIOL, BIOM, BIOO, or BCH, with at least one course from each subcategory Criterion: C- Number of Credits 21

Course Listing Commentary:

Subcategory Name: Organismal Course Requirement

Rule: Complete at least one organismal course (lab must also be taken, if available) from the following list

Criterion: C-

Course Listing	Number of Credits		
BIOB 301	Developmental Biology	3	S
BIOB 375	General Genetics	3	S
BIOB 468	Endocrinology	3	I
BIOE 403	Vert Design & Evolution	5	F
BIOL 435	Comparative Animal Physiology	3	S
BIOO 433	Plant Physiology	3	S

Commentary: If BIOO 433 Plant Physiology, then BIOO 434 Plant Physiology Lab must also be taken.

Subcategory Name: -Ology Course Requirement

Rule: Complete at least one course with a focus on a group of organisms (lab must also be taken, if available) from the following list

Criterion: C-

Course Listing	Number of Credits		
BIOM 360	Gen Microbiology (equiv to 260)	3	F,S
BIOM 427	General Parasitology	2	F
BIOO 320	General Botany	5	F
BIOO 335	Rocky Mountain Flora	3	S,SU
BIOO 340	Biology and Mgmt of Fishes	4	F
BIOO 462	Entomology	4	SE

BIOO 470 Ornithology 4 S

BIOO 475 Mammalogy 4 F

Commentary: If BIOM 360 General Microbiology, then BIOM 361 General Microbiology Lab must also be taken. If BIOM 427 General Parasitology, then BIOM 428 General Parasitology Lab must also be taken.

Subcategory Name: Specialized Ecology Course Requirement

Rule: Complete at least one specialized ecology course from the following list

Criterion: C- Number of Credits

Course Listing

BIOE 428 Freshwater Ecology 5 F

BIOE 447 Terrestrial Ecosystem Ecology 3 I

BIOE 448 Terrestrial Plant Ecology 4 F

BIOE 449 Plant Biogeography 3 I

BIOM 415 Microbial Dvrsty Eclgy & Evltn 3 S

WILD 346 Wildlife Physiological Ecology 3 F

WILD 470 Conserv of Wildlife Populatns3 F,S

Commentary: A specialized ecology course taken at the Flathead Lake Biological Station (BIOE 416, 439, 440, 451, 453, or 458) may be substituted for this requirement.

Subcategory Name: Evolution Course Requirement

Rule: Complete at least one evolutionary biology course from the following list

Criterion: C-

Course Listing Number of Credits

BIOB 480 Conservation Genetics 3 S

BIOB 483 Phylogenetics and Evolution 3

BIOB 486 Genomics 3 F

BIOE 406 Behavior & Evolution 4 F

BIOE 482 Evolution & Development 3 I

BIOL 484 Plant Evolution 3 I

Commentary: Other recommended courses include BCH 380 or BCH 480-482.

Cognates

Category Name: Required Courses Outside of the Major Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics - Calculus

Rule: Complete one of the following calculus courses

Criterion: C- Number of Credits 4

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: Choose M 171, if you plan to take additional calculus courses, or if you plan a double major or minor in a field that requires more calculus (e.g. math, physics, biochemistry, computer science).

Subcategory Name: Mathematics - Statistics

Rule: Complete either one semester of statistics (STAT 216) or a full year of statistics (STAT 451/457 and 452/458)

Criterion: C-

Course Listing		Number of Credits	4 or 8	
STAT 216	Introduction to Statistics	4		F,S,SU
STAT 451	Statistical Methods I	3	F	
STAT 452	Statistical Methods II	3	S	
STAT 457	Computer Data Analysis I	1	F	
STAT 458	Computer Data Analysis II	1	S	

Commentary: Choose the full year of statistics for graduate preparation in ecology.

Subcategory Name: Chemistry

Rule: Complete either one year of chemistry (CHMY 121N, 123N/124N) or two years of chemistry (CHMY 141N, 143N, 221/222, 223/224) Criterion: C-

Number of Credits 8 or 20

Course Listing

CHMY 121N	Intro to General Chemistry	3	F,S,SU
CHMY 123N	Intro to Organic & Biochem	3	F,S,SU
CHMY 124N	Intro to Organic & Biochem Lab	2	F,S,SU
CHMY 141N	College Chemistry I	5	F,S
CHMY 143N	College Chemistry II	5	S,SU
CHMY 221	Organic Chem I	3	F
CHMY 222	Org Chm I Lab	2	F
CHMY 223	Organic Chm II	3	S
CHMY 224	Org Chm II Lab	2	S

Commentary: Choose the two year sequence of chemistry for graduate preparation in organismal biology, or if you are pre-veterinary.

Subcategory Name: Physics

Rule: All of the following courses are required.

Criterion: C- Number of Credits 10

Course Listing

PHSX 205N	College Physics I	4	F,S,SU
PHSX 206N	College Physics I Laboratory	1	F,S,SU
PHSX 207N	College Physics II	4	F,S,SU
PHSX 208N	College Physics II Laboratory	1	F,S,SU

Commentary: These are algebra- and trigonometry-based physics courses. The calculus-based physics sequence, PHSX 215N/216N & 217N/218N (which require M 171 and M 172), may be substituted for PHSX 205N/206N & 207N/208N.

Upper Division Writing

Category Name: Upper Division Writing Expectation for the Major

Rule: Complete the equivalent of a full writing course (either three 1/3 writing courses or one 2/3 writing course + one 1/3 writing course or one complete writing course)

Criterion: C- Number of Credits

Course Listing

Commentary: To meet the Upper Division Writing Expectation for the Major, Biology students take 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Ecology & Organismal Biology Option requires one 2/3 writing course (BIOE 371). The UD Writing Expectation for the Major is completed with one more course, chosen from any of the following.

Subcategory Name: 1/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 482	Advanced Biochemistry II	3	S
BIOB 410	Immunology	3	F
BIOB 425	Adv Cell & Molecular Biology	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOE 403	Vert Design & Evolution	5	F
BIOE 409	Behavior & Evolution Discussion	1	
BIOE 428	Freshwater Ecology	5	F
BIOL 484	Plant Evolution	3	I
BIOM 402	Medical Bacteriology & Mycology	3	S
BIOO 320	General Botany	5	F
BIOO 434	Plant Physiology Lab	1	S
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary:

Subcategory Name: 2/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 486	Biochemistry Research Lab	3	S
BCH 499	Senior Thesis/Capstone	3 To 6	F,S,SU
BIOB 411	Immunology Laboratory	2	F
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU
BIOE 342	Field Ecology	5	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F
BIOM 411	Exprmntl Microbial Genetcs Lab	1	
BIOM 499	Undergraduate Thesis	3 To 6	F,S,SU

Commentary:

Subcategory Name: Complete UD Writing Course Rule:

Criterion: Number of Credits

Course Listing

BIOH 462 Principles Medical Physiology 3

Commentary:

Degree Specific Symbolic Systems

Category Name: Exception to the Modern/Classical Languages Requirement Rule: Choose one of the following Math courses

Criterion: C- Number of Credits

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: The Division of Biological Sciences has been granted an exception to the Modern/Classical Language Requirement. Either of these Calculus courses (required by the major) will satisfy this requirement.

Degree Commentary: The Ecology and Organismal Biology option is for students interested in the biology of organisms (plants or animals) or the biology of populations and communities. Course offerings include those from organismal biology, ecology, evolutionary biology, and conservation biology. This option is a graduate prep program, and it is designed for students interested in academia or employment with government agencies (e.g. National Biological Survey, U.S. FWS, etc.), or environmental consulting agencies. This option is also an excellent choice for pre-veterinary students.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: **Major** Subject: **Biology** Option: **Field Ecology**

Total Credits: 69 Cumulative GPA Required: 2.0

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing Number of Credits 17

BIOB 160N Principles of Living Systems 4 F,SU

BIOB 170N Princpls Biological Diversity 3 S,SU

BIOB 171N Princpls Biological Dvrsty Lab 2 S,SU

BIOB 260 Cellular and Molecular Biology 4 F,SU

BIOB 272 Genetics and Evolution 4 S,SU
Commentary: The lower division core should be completed before attempting most upper division major courses.

AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Commentary: Upper Division Core

Category Name: Upper Division Core Courses Required for the Field Ecology Option

Rule: Complete the on-campus general ecology lecture and lab (BIOE 370/371) or the field ecology course at the Flathead Lake Biological Station (BIOL 342)

Criterion: C- Number of Credits 5

Course Listing

BIOE 342	Field Ecology	5	SU	
BIOE 370	General Ecology	3	F	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F	

Commentary:

Commentary: Major Electives

Category Name: Additional Upper Division Major Courses Required for the Field Ecology Option

Rule: Complete a minimum of 8 credits of Upper Division Biology or Microbiology, with at least one course from each subcategory Criterion: C- Number of Credits 8

Course Listing Commentary:

Subcategory Name: Evolution Course Requirement

Rule: Complete at least one evolutionary biology course from the following list

Criterion: C-

Course Listing	Number of Credits		
BIOB 480	Conservation Genetics	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOB 486	Genomics	3	F
BIOE 406	Behavior & Evolution	4	F
BIOE 482	Evolution & Development	3	I
BIOL 484	Plant Evolution	3	I

Commentary:

Subcategory Name: -Ology Course Requirement

Rule: Complete at least one course with a focus on a group of organisms (lab must also be taken, if available) from the following list Criterion: C- Number of Credits

Course Listing

BIOM 360	Gen Microbiology (equiv to 260)	3	F,S
BIOM 427	General Parasitology	2	F
BIOO 320	General Botany	5	F
BIOO 335	Rocky Mountain Flora	3	S,SU
BIOO 340	Biology and Mgmt of Fishes	4	F
BIOO 462	Entomology	4	SE
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary: If BIOM 360 General Microbiology, then BIOM 361 General Microbiology Lab must also be taken. If BIOM 427 General Parasitology, then BIOM 428 General Parasitology Lab must also be taken.

Commentary: Major Electives

Category Name: Ecology Requirement at the Flathead Lake Biological Station Rule: Complete either the Aquatic Emphasis or the Terrestrial Emphasis Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Aquatic Emphasis

Rule: All of the following courses are required for the Aquatic Emphasis

Criterion: C-

Course Listing		Number of Credits	13	
BIOE 439	Stream Ecology	3		SU
BIOE 440	Conservation Ecology	3		SU
BIOE 451	Landscape Ecology	3		SU
BIOE 453	Ecology of Small & Large Lakes	3		SU
BIOL 492	Seminars in Ecol & Res Man	1		SU

Commentary:

Subcategory Name: Terrestrial Emphasis

Rule: All of the following courses are required for the Terrestrial Emphasis

Criterion: C-

Course Listing		Number of Credits	13	
BIOE 416	Alpine Ecology	3		SU
BIOE 440	Conservation Ecology	3		SU
BIOE 451	Landscape Ecology	3		SU
BIOE 458	Forest and Grassland Ecol	3		SU
BIOL 492	Seminars in Ecol & Res Man	1		SU

Commentary: Cognates

Category Name: Required Courses Outside of the Major Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics - Calculus Rule: Required

Criterion: C- Number of Credits 4

Course Listing

M 162 Applied Calculus 4 F,S

Commentary: M 171 (Calculus I) may be substituted for M 162.

Subcategory Name: Mathematics - Statistics

Rule: Complete either one semester of statistics (STAT 216) or a full year of statistics (STAT 451/457 and 452/458)

Criterion: C-

Course Listing		Number of Credits	4 or 8	
STAT 216	Introduction to Statistics	4		F,S,SU
STAT 451	Statistical Methods I	3		F
STAT 452	Statistical Methods II	3		S

STAT 457 Computer Data Analysis I 1 F

STAT 458 Computer Data Analysis II 1 S

Commentary:

Subcategory Name: Chemistry

Rule: Complete either one year of chemistry (CHMY 121N, 123N/124N) or two years of chemistry (CHMY 141N, 143N, 221/222, 223/224)

Criterion: C- Number of Credits 8 or 20

Course Listing

CHMY 121N Intro to General Chemistry 3 F,S,SU

CHMY 123N Intro to Organic & Biochem 3 F,S,SU

CHMY 124N Intro to Organic & Biochem Lab 2 F,S,SU

CHMY 141N College Chemistry I 5 F,S

CHMY 143N College Chemistry II 5 S,SU

CHMY 221 Organic Chem I 3 F

CHMY 222 Org Chm I Lab 2 F

CHMY 223 Organic Chm II 3 S

CHMY 224 Org Chm II Lab 2 S Commentary:

Subcategory Name: Physics

Rule: All of the following courses are required

Criterion: C- Number of Credits 10

Course Listing

PHSX 205N College Physics I 4 F,S,SU

PHSX 206N College Physics I Laboratory 1 F,S,SU

PHSX 207N College Physics II 4 F,S,SU

PHSX 208N College Physics II Laboratory 1 F,S,SU

Commentary: These are algebra- and trigonometry-based physics courses. The calculus-based physics sequence, PHSX 215N/216N & 217N/218N (which require M 171 and M 172), may be substituted for PHSX 205N/206N & 207N/208N.

Commentary:

Upper Division Writing

Category Name: Upper Division Writing Expectations for the Major

Rule: Complete the equivalent of a full writing course (either three 1/3 writing courses or one 2/3 writing course + one 1/3 writing course or one complete writing course)

Criterion: C- Number of Credits

Course Listing

Commentary: To meet the Upper Division Writing Expectation for the Major, Biology students take 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Field Ecology Option requires BIOE 371 or BIOE 342 (both 2/3 writing courses). The UD writing requirement is completed with one additional course, chosen from any of the following.

Subcategory Name: 1/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 482	Advanced Biochemistry II	3	S
BIOB 410	Immunology	3	F
BIOB 425	Adv Cell & Molecular Biology	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOE 403	Vert Design & Evolution	5	F
BIOE 409	Behavior & Evolution Discussion	1	
BIOE 428	Freshwater Ecology	5	F
BIOL 484	Plant Evolution	3	I
BIOM 402	Medical Bacteriology & Mycology	3	S
BIOO 320	General Botany	5	F
BIOO 434	Plant Physiology Lab	1	S
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary:

Subcategory Name: 2/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 486	Biochemistry Research Lab	3	S
BCH 499	Senior Thesis/Capstone	3 To 6	F,S,SU
BIOB 411	Immunology Laboratory	2	F
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU
BIOE 342	Field Ecology	5	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F
BIOM 411	Exprmntl Microbial Genetcs Lab	1	
BIOM 499	Undergraduate Thesis	3 To 6	F,S,SU

Commentary:

Subcategory Name: Complete UD Writing Course Rule:

Criterion: Number of Credits

Course Listing

BIOH 462	Principles Medical Physiology	3	
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Commentary:

Degree Specific Symbolic Systems

Category Name: Exception to the Modern/Classical Languages Requirement Rule: Choose one of the following Math courses

Criterion: C- Number of Credits

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: The Division of Biological Sciences has been granted an exception to the Modern/Classical Language Requirement. Either of these Calculus courses (required by the major) will satisfy this requirement.

Degree Commentary: The Field Ecology option is for students interested in field-based ecology. Students with this option spend one or two summers taking field courses at the Flathead Lake Biological Station. This option is a graduate prep program, and is for students interested in academia or employment at a governmental, private or non-profit agency.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: Major Subject: **Biology** Option: **Genetics and Evolution**

Total Credits: 70 Cumulative GPA Required: 2.0

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing	Number of Credits	17
BIOB 160N Principles of Living Systems	4	F,SU
BIOB 170N Princpls Biological Diversity	3	S,SU
BIOB 171N Princpls Biological Dvrsty Lab	2	S,SU
BIOB 260 Cellular and Molecular Biology	4	F,SU
BIOB 272 Genetics and Evolution	4	S,SU

Commentary: The lower division core should be completed before attempting most upper division major courses. AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Upper Division Core

Category Name: Upper Division Core Courses Required by the Genetics & Evolution Option Rule: All of the following courses are required.

Criterion: C-

Course Listing	Number of Credits	11
BIOB 375 General Genetics	3	S
BIOB 486 Genomics	3	F
BIOE 370 General Ecology	3	F
BIOE 371 Gen Ecology Lab (equiv to 271)	2	F

Commentary: Major Electives

Category Name: Additional UD Major Courses Required for the Genetics & Evolution Option Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Biochemistry

Rule: Complete either one semester of biochemistry (BCH 380) or two semesters of biochemistry (BCH 480-482)

Criterion: C- Number of Credits 4 or 6

Course Listing

BCH 380 Biochemistry 4 F,S

BCH 480 Advanced Biochemistry I 3 F

BCH 482 Advanced Biochemistry II 3 S

Commentary: If one year of chemistry is completed, then BCH 380 must be taken. Either BCH 380 or BCH 480-482 may be taken if two years of chemistry are completed.

Subcategory Name: Genetics/Evolution Depth Courses

Rule: Complete at least three of the following genetics/evolution courses

Criterion: C-

Course Listing Number of Credits 9-12

BIOB 480 Conservation Genetics 3 S

BIOB 483 Phylogenetics and Evolution 3

BIOE 403 Vert Design & Evolution 5 F

BIOE 406 Behavior & Evolution 4 F

BIOE 482 Evolution & Development 3 I

BIOL 484 Plant Evolution 3 I

BIOM 410 Microbial Genetics 3 S

BIOM 415 Microbial Dvrsty Eclgy & Evltn 3 S

CSCI 451 Computational Biology 3 F

Subcategory Name: Physiology Requirement

Rule: Complete at least one of the following courses (labs must also be taken, if available)

Criterion: C-

Course Listing Number of Credits 3 or 4

BIOB 425 Adv Cell & Molecular Biology 3 S

BIOL 435 Comparative Animal Physiology 3 S

BIOM 450 Microbial Physiology 3 F

BIOO 433 Plant Physiology 3 S

Commentary: If BIOM 450 Microbial Physiology, then BIOM 451 Microbial Physiology Lab must also be taken.

If BIOO 433 Plant Physiology, then BIOO 434 Plant Physiology Lab must also be taken.

Commentary: Cognates

Category Name: Required Courses Outside of the Major

Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics - Calculus

Rule: Complete one of the following calculus courses

Criterion: C- Number of Credits 4

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: Choose M 171 if you plan to take additional calculus courses, or if you plan a double major or minor in a field that requires more calculus (e.g. math, physics, biochemistry, computer science).

Subcategory Name: Mathematics - Statistics

Rule: Complete either one semester of statistics (STAT 216) or a full year of statistics (STAT 451/457 and 452/458)

Criterion: C- Number of Credits 4 or 8

Course Listing

STAT 216 Introduction to Statistics 4 F,S,SU

STAT 451 Statistical Methods I 3 F

STAT 457 Computer Data Analysis I 1 F

STAT 458 Computer Data Analysis II 1 S

Commentary:

Subcategory Name: Chemistry

Rule: Complete either one year of chemistry (CHMY 121N, 123N/124N) or two years of chemistry (CHMY 141N, 143N, 221/222, 223/224) Criterion: C- Number of Credits 8 or 20

Course Listing

CHMY 121N Intro to General Chemistry 3 F,S,SU

CHMY 123N Intro to Organic & Biochem 3 F,S,SU

CHMY 124N Intro to Organic & Biochem Lab 2 F,S,SU

CHMY 141N College Chemistry I 5 F,S

CHMY 143N College Chemistry II 5 S,SU

CHMY 221 Organic Chem I 3 F

CHMY 222 Org Chm I Lab 2 F

CHMY 223 Organic Chm II 3 S

CHMY 224 Org Chm II Lab 2 S

Commentary:

Subcategory Name: Physics

Rule: All of the following courses are required

Criterion: C- Number of Credits 10

Course Listing

PHSX 205N College Physics I 4 F,S,SU

PHSX 206N College Physics I Laboratory 1 F,S,SU

PHSX 207N College Physics II 4 F,S,SU

PHSX 208N College Physics II Laboratory 1 F,S,SU

Commentary: These are algebra- and trigonometry-based physics courses. The calculus-based physics sequence, PHSX 215N/216N & 217N/218N (which require M 171 and M 172), may be substituted for PHSX 205N/206N & 207N/208N.

Upper Division Writing

Category Name: Upper Division Writing Expectation for the Major

Rule: Complete the equivalent of a full writing course (either three 1/3 writing courses or one 2/3 writing course + one 1/3 writing course or one complete writing course)

Criterion: C- Number of Credits

Course Listing

Commentary: To meet the Upper Division Writing Expectation for the Major, Biology students take 2 or 3 partial writing courses (either three 1/3 writing courses or one 1/3 writing course and one 2/3 writing course) or one complete writing course. The Genetics & Evolution Option requires one 2/3 writing course: BIOE 371. The UD

Subcategory Name: 1/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 482	Advanced Biochemistry II	3	S
BIOB 410	Immunology	3	F
BIOB 425	Adv Cell & Molecular Biology	3	S
BIOB 483	Phylogenetics and Evolution	3	
BIOE 403	Vert Design & Evolution	5	F
BIOE 409	Behavior & Evolution Discussion	1	
BIOE 428	Freshwater Ecology	5	F
BIOL 484	Plant Evolution	3	I
BIOM 402	Medical Bacteriology & Mycology	3	S
BIOO 320	General Botany	5	F
BIOO 434	Plant Physiology Lab	1	S
BIOO 470	Ornithology	4	S
BIOO 475	Mammalogy	4	F

Commentary:

Subcategory Name: 2/3 UD Writing Courses Rule:

Criterion: C- Number of Credits

Course Listing

BCH 486	Biochemistry Research Lab	3	S
BCH 499	Senior Thesis/Capstone	3 To 6	F,S,SU
BIOB 411	Immunology Laboratory	2	F
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU
BIOE 342	Field Ecology	5	
BIOE 371	Gen Ecology Lab (equiv to 271)	2	F
BIOM 411	Exprmntl Microbial Genetcs Lab	1	
BIOM 499	Undergraduate Thesis	3 To 6	F,S,SU

Commentary:

Subcategory Name: Complete UD Writing Course Rule:

Criterion: Number of Credits

Course Listing

BIOH 462 Principles Medical Physiology 3

Commentary:

Degree Specific Symbolic Systems

Category Name: Exception to the Modern/Classical Languages Requirement Rule: Choose one of the following Math courses

Criterion: C- Number of Credits

Course Listing

M 162 Applied Calculus 4 F,S

M 171 Calculus I 4 F,S

Commentary: The Division of Biological Sciences has been granted an exception to the Modern/Classical Language Requirement. Either of these Calculus courses (required by the major) will satisfy this requirement.

Degree Commentary: Genetics and evolution is for students interested in genetics and evolutionary biology, including molecular genetics, population genetics, ecological genetics, and genomics. This option is a graduate prep program, and is for students interested in academia or research jobs in private or government laboratories. It is also an excellent option for students interested in a professional health program such as medical school or a genetic counseling graduate program.

College Humanities & Sciences Catalog Year: 2015-2016

Degree Type: Bachelor of Arts Level: **Major** Subject: **Biology** Option: **Human Biological Sciences**

Total Credits: 74 Cumulative GPA Required: 2.0

Lower Division Core

Category Name: Biology/Microbiology Lower Division Core Rule: All of the following courses are required.

Criterion: C-

Course Listing Number of Credits 17

BIOB 160N Principles of Living Systems 4 F,SU

BIOB 170N Princpls Biological Diversity 3 S,SU

BIOB 171N Princpls Biological Dvrsty Lab 2 S,SU

BIOB 260 Cellular and Molecular Biology 4 F,SU

BIOB 272 Genetics and Evolution 4 S,SU

Commentary: The lower division core should be completed before attempting most upper division major courses. AP Biology credit may be substituted for either BIOB 160N or BIOB 170N/171N.

Commentary:

Category Name: Upper Division Core Courses Required by Human Biological Sciences Option Rule: All of the following courses are required.

Criterion: C-

Course Listing Number of Credits 14

BIOB 301 Developmental Biology 3 S

BIOB 375	General Genetics	3	S	
BIOH 365	Human AP I for Health Profsns	4	F,SU	
BIOH 370	Human AP II for Health Profsns	4	S	

Commentary: Major Electives

Category Name: Additional Upper Division Major Courses Required for the Human Biological Sciences Option
Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Biochemistry Requirement

Rule: Complete either one semester of biochemistry (BCH 380) or a full year of biochemistry (BCH 480-482)

Criterion: C- Number of Credits 4 or 6

Course Listing

BCH 380	Biochemistry	4	F,S	
BCH 480	Advanced Biochemistry I	3	F	
BCH 482	Advanced Biochemistry II	3	S	

Commentary: If one year of chemistry is completed, then BCH 380 must be taken. Either BCH 380 or BCH 480-482 may be taken if two years of chemistry are completed.

Subcategory Name: Microbiology Requirement

Rule: Complete either BIOM 400 or both BIOM 360 and 361

Criterion: C- Number of Credits 3 or 5

Course Listing

BIOM 360	Gen Microbiolgy (equiv to 260)	3	F,S	
BIOM 361	Gen Microbiolgy Lb (equiv 261)	2	F,S	
BIOM 400	Medical Microbiology	3	F	

Commentary:

Subcategory Name: Additional Depth in Human Biological Sciences Rule: Complete at least two courses from the following list

Criterion: C- Number of Credits 6 - 9

BCH 486	Biochemistry Research Lab	3	S	
BIOB 410	Immunology	3	F	
BIOB 425	Adv Cell & Molecular Biology	3	S	
BIOB 468	Endocrinology	3	I	
BIOB 483	Phylogenetics and Evolution	3		
BIOB 486	Genomics	3	F	
BIOB 499	Undergraduate Thesis	3 To 6	F,S,SU	
BIOE 403	Vert Design & Evolution	5	F	
BIOE 406	Behavior & Evolution	4	F	
BIOE 482	Evolution & Development	3	I	
BIOH 462	Principles Medical Physiology	3	S	

BIOL 435	Comparative Animal Physiology	3	S
BIOM 402	Medical Bacteriology& Mycology	3	S
BIOM 410	Microbial Genetics	3	S
BIOM 427	General Parasitology	2	F
BIOM 435	Virology	3	S
BIOM 450	Microbial Physiology	3	F

Commentary: If BIOM 427 General Parasitology taken, then BIOM 428 General Parasitology Lab must also be taken.

Commentary: Cognates

Category Name: Required Courses Outside of the Major Rule:

Criterion: C- Number of Credits

Course Listing Commentary:

Subcategory Name: Mathematics and Psychology Rule: All of the following courses are required

Criterion: C- Number of Credits 12

Course Listing

M 162	Applied Calculus	4	F,S
PSYX 100S	Intro to Psychology	4	F,S,SU
STAT 216	Introduction to Statistics	4	F,S,SU

Commentary: M 171 Calculus I may be substituted for M 162.

Subcategory Name: Chemistry

Rule: Complete either one year of chemistry (CHMY 121N, 123N/124N) or two years of chemistry (CHMY 141N, 143N, 221/222, 223/224)

Course Listing

CHMY 121N	Intro to General Chemistry	3	F,S,SU
CHMY 123N	Intro to Organic & Biochem	3	F,S,SU
CHMY 124N	Intro to Organic & Biochem Lab	2	F,S,SU
CHMY 141N	College Chemistry I	5	F,S
CHMY 143N	College Chemistry II	5	S,SU
CHMY 221	Organic Chem I	3	F
CHMY 222	Org Chm I Lab	2	F
CHMY 223	Organic Chm II	3	S
CHMY 224	Org Chm II Lab	2	S

Commentary: If you plan to apply to a graduate or professional school such as medical or dental, you should plan to complete the two year sequence in chemistry. If you plan to pursue nursing or a graduate program in physical therapy, the one year sequence of chemistry is sufficient. The two year chemistry option is more flexible, and keeps more options open for future careers. Check the requirements of your intended professional program to help determine which sequence is right for you.

Subcategory Name: Physics

Rule: All of the following courses are required.