



Secondary Science Education

College of Education

Requirements for Program

This B.A. includes completion of an approved plan in the academic specialty teaching of Secondary Physical Science or Biological Science. **The approved majors and minors in the academic specialties for teaching are entitled physical science major for secondary education or biological science major for secondary education to distinguish them from the Arts & Sciences majors and minors. No certification is awarded with the B.A.** Students desiring to go on to Masters with initial certification must apply to The Graduate School and apply to the Secondary Science Program Faculty in the spring of their senior year.

To receive the B.A. degree, students must: (1) complete the University Studies Program, and Program Related Studies; (2) complete at least 128 semester hours; (3) complete one of the Secondary Science Education plans; (4) attain grade-point average of at least 2.50, overall and in the chosen major/minor/support areas; and (5) complete 100 hours of fieldwork with adolescents through the **required** three hour course:

EDC 362 Field Experiences in Secondary Education 3

The Secondary Science Education program addresses the content area requirements of Kentucky's *New Teacher Standards*, National Research Council's *National Science Education Standards*, and the National Science Teachers Association *Guidelines*. The program encourages the understanding and development of major concepts within a specialty area as well as an understanding of the interconnectedness of the sciences. Students are encouraged to apply mathematics to investigations of science, including analyses of data. It is intended that students relate the concepts of science to contemporary, historical, technological and societal issues. As future science teachers, students will need to locate resources, design and conduct inquiry-based and open-ended investigations, interpret findings, communicate results and make judgments based upon evidence. Specifically, the program encourages the teaching of science through a problem-solving, inquiry-based approach.

Continuous Assessment

1. All secondary education majors must be admitted to advanced standing after completing 60 hours. Advanced standing requires (a) 2.50 minimum GPA overall, and (b) review by program faculty advisor for Secondary Science Education.
2. Because certification occurs through the Masters in Education including certification (MIC), students should be aware that they will need to be formally admitted to the MIC program. Admission/Retention/Exit regulations for all teacher certification programs are specified in the section "Admission, Retention and Exit from Teacher Education Programs" on page 172 of the *2008-2009 UK Bulletin*.
3. Oral and written communication skills of applicants for the MIC program in secondary science education will be assessed at the time of the interview, and through the entrance portfolio.
4. Admission to the Masters in Education with certification is competitive. At the time of application to the science education program, applicants will be evaluated on the basis of GPA, GRE scores, graded and on-site writing tasks, verbal communication, quality of references, commitment to teaching, social awareness, educational experiences with diverse learn-

ers, 14-18 year olds, and multicultural experiences, and quality of work in the sciences.

Statement on Student Teaching

There is no student teaching required for completion of the secondary science education major. Student teaching occurs as part of the Masters in Education with initial certification.

University Studies (39-53 hours)

*See *University Studies Program* section of the *2008-2009 UK Bulletin* for listing of allowable courses in each area below.

Program Related Studies (6 hours)

EDC 362 Field Experiences in Secondary Education	3
CS 101 Introduction to Computing I	3

Majors and Minors (54-72 hours)

Plans for Majors, Minors, and Supporting Subjects

Candidates may choose to be certified in one of two science areas, 1) biological science, or 2) physical science. Biological science candidates must have a biological science major for secondary education and follow one of the biological science plans. Physical science candidates must have a chemistry major for secondary education, earth science major for secondary education, physical science major for secondary education, or physics major for secondary education and follow one of the physical science plans.

Plans for Biological Science Candidates

Plan 1

Major (33 hours in biological science) plus: (A) a supporting **non-certifiable** minor of (21 hours) in mathematics, OR (B) a supporting **non-certifiable** minor in one of the other sciences. The science fields from which the minor may be chosen include chemistry, earth science, and physics.

Plan 2

Major (33 hours in biological science) with two 12-hour supporting subjects. The 12-hour blocks of support-subjects may be chosen from two of the following fields: chemistry, earth science, physics, or mathematics.

Plan 3

Major (33 hours in biological science) and four supporting subjects. Students selecting Plan 3 will complete a major in biology and take a total of 24 semester hours from chemistry, earth science, physics, and mathematics, with a minimum of three semester hours in each field.

Plans for Physical Science Candidates

Plan 1

Major (33 hours in either chemistry, earth science, or physics) plus: (A) a supporting **non-certifiable** minor of (21 hours) in mathematics, OR (B) a supporting minor in one of the other sciences. The science fields from which the minor may be chosen include biology (non-certifiable), chemistry, earth science, and physics, and mathematics (non-certifiable).

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Plan 2

Major (33 hours in either chemistry, earth science, or physics) with two 12-hour supporting subjects. The 12-hour blocks of support-subjects may be chosen from two of the following fields: biology, chemistry, earth science, physics, or mathematics. Courses from the major may not be applied to the support-subjects requirement.

Plan 3

Major (33 hours in either chemistry, earth science, or physics) and four supporting subjects. Students selecting Plan 3 will complete a total of 24 semester hours from biology, chemistry, earth science, physics, and mathematics, with a minimum of three semester hours in each field. Courses from the major may not be applied to the support-subjects requirement.

Plan 4

Students will complete a physical science for secondary education major. The physical science major consists of 21 hour minors in chemistry, earth science, and physics. Minors from each field must be included in the physical science major.

Major Requirements

All majors for secondary science education require a minimum of 33 hours.

Biological Science Major for Secondary Education (33 hours)

Required Support Courses

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
PHY 211/213 General Physics	10

or

PHY 231/232 General University Physics	
PHY 241/242 General University Physics Laboratory	10
GLY 220 Principles of Physical Geology	4

and

MA 123 Elementary Calculus and Its Applications	
MA 113 Calculus I	
MA 132 Calculus for the Life Sciences	3-4

Recommended Support Courses

CHE 230 Organic Chemistry I	3
CHE 231 Organic Chemistry Laboratory I	2
CHE 232 Organic Chemistry II	3
CHE 233 Organic Chemistry Laboratory II	2
BCH 401G Fundamentals of Biochemistry	3

Required for Major

BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2
BIO 152 Principles of Biology II	3
BIO 153 Principles of Biology Laboratory II	2
BIO 325 Introductory Ecology	4

BIO 304 Principles of Genetics

or

ABT 360 Genetics	3-4
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Upper Level Botany Course

BIO 351 Plant Kingdom	
BIO 430G Plant Physiology	3

Upper Level Zoology Course

BIO 350 Animal Physiology (highly recommended)	4
BIO electives (chosen with aid of advisor)	

Recommended for Major

BIO 315 Introduction to Cell Biology	3
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Chemistry Major for Secondary Education (33 hours)

Required Support Courses

MA 113 Calculus I	4
MA 114 Calculus II	4
PHY 211/213 General Physics	10

or

PHY 231/232 General University Physics	
PHY 241/242 General University Physics Laboratory	10

and

GLY 220 Principles of Physical Geology	4
BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2

Recommended Support Courses

AST 191 The Solar System	3
MA 213 Calculus III	4

Required for Major

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
CHE 230 Organic Chemistry I	3
CHE 231 Organic Chemistry Laboratory I	2
CHE 232 Organic Chemistry II	3
CHE 233 Organic Chemistry Laboratory II	2
CHE 226 Analytical Chemistry	3-4
BCH 401G Fundamentals of Biochemistry	3
CHE 440G Introductory Physical Chemistry	4

Recommended Courses in Major

Additional courses selected with aid of advisor.

Earth Science Major for Secondary Education (33 hours)*

Required Support Courses

MA 123 Elementary Calculus and Its Applications	
MA 113 Calculus I	3-4

or

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
PHY 211/213 General Physics	10

or

PHY 231/232 General University Physics	
PHY 241/242 General University Physics Laboratory	10

and

BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2

Required for Major

AST 191 The Solar System	3
GEO 130 Earth's Physical Environment	
GEO 230 Weather and Climate	3

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GLY 220 Principles of Physical Geology	4
or	
GLY 223 Introduction to Geology in the Rocky Mountains	6
GLY 230 Fundamentals of Geology I	3
GLY 235 Fundamentals of Geology II	3
GLY 360 Mineralogy	
or	
GLY 401G Invertebrate Paleobiology and Evolution	3-4

Recommended for Major

The following list contains courses that are normally applied to the major.

AST 192 Stars, Galaxies and the Universe	3
GLY 360 Mineralogy (if not taken above)	4
GLY 401G Invertebrate Paleobiology and Evolution (if not taken above)	3
GLY 341 Landforms	3
PLS 366 Fundamentals of Soil Science	4
Oceanography course (if transferred from another university)	3
Earth Science electives to be selected with the aid of advisor.	

**Note: Students should note that earth science is generally taught in Kentucky at the eighth grade level. In many states it is taught at the ninth grade level; therefore, secondary OR middle school certification could be required. You must decide the level of certification that fits your needs. If you plan to teach in Kentucky, you may want to follow either of the following options: 1) obtain science certification through the middle school program or 2) obtain earth science certification through the secondary education program. Currently, the Kentucky Department of Education is allowing secondary science teachers to teach science in the 7th and 8th grades without having middle school certification. The option for secondary certification provides more extensive content preparation in earth science.*

Physical Science Major for Secondary Education (33 hours)

Required Support Courses

MA 113 Calculus I	4
MA 114 Calculus II	4
BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2

Recommended Support Courses for Major

MA 213 Calculus III	4
*MA 214 Calculus IV	3

**Note mathematics requirements for upper-level chemistry and physics courses.*

Required for Physical Science Major

Chemistry:

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
CHE 230 Organic Chemistry I	3
CHE 231 Organic Chemistry Laboratory I	2
CHE 226 Analytical Chemistry	3-4
CHE electives (chosen with aid of advisor)	

Physics:

AST 191 The Solar System	3
AST 192 Stars, Galaxies and the Universe	3
PHY 211/213 General Physics	10
or	
PHY 231/232 General University Physics	
and	
PHY 241/242 General University Physics Laboratory	10
PHY 361 Principles of Modern Physics	3
PHY electives (chosen with aid of advisor)	

Earth Science:

AST 191 The Solar System	3
AST 192 Stars, Galaxies and the Universe	3
GLY 220 Principles of Physical Geology	4
or	
GLY 223 Introduction to Geology in the Rocky Mountains	6
GLY 230 Fundamentals of Geology I	3
GLY 235 Fundamentals of Geology II	3
GLY 360 Mineralogy	
or	
GLY 401G Invertebrate Paleobiology and Evolution	3-4
Earth Science Electives (chosen with aid of advisor)	

Recommended Courses for Physical Science Major

CHE 232 Organic Chemistry II	3
CHE 233 Organic Chemistry Laboratory II	2
BCH 401G Fundamentals of Biochemistry	3
CHE 440G Introductory Physical Chemistry	3
GLY 360 Mineralogy	
or	
GLY 401G Invertebrate Paleobiology and Evolution	3-4
GEO 130 Earth's Physical Environment	
or	
GEO 230 Weather and Climate	3
PHY 404G Mechanics	3
PHY 417G Electricity and Magnetism	3

Physics Major for Secondary Education (33 hours)

Required Support Courses

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
MA 113 Calculus I	4
MA 114 Calculus II	4
GLY 220 Principles of Physical Geology	4
BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2

Recommended Support Courses

MA 213 Calculus III	4
*MA 214 Calculus IV	3

**Note mathematics requirements for upper-level physics courses.*

Required for Major

PHY 231/232 General University Physics	5
PHY 241/242 General University Physics Laboratory	5
PHY 361 Principles of Modern Physics	3
PHY electives (chosen with aid of advisor)	

Recommended for Major

AST 191 The Solar System	
or	
*PHY 151 Introduction to Physics	3
AST 192 Stars, Galaxies and the Universe	
or	
*PHY 152 Introduction to Physics	3

Note: A maximum of nine hours of astronomy may be counted toward the 33 hour physics requirement. A student may **not count both the AST 191, 192 and PHY 151, 152 sequences toward the physics major for secondary education. If PHY 151 and PHY 152 are applied to the major, they must be completed prior to taking the PHY 231, 241, 232, 242 sequence.*

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MINOR REQUIREMENTS

A minor in one of the sciences or mathematics is required for Plans 1 of the biological science and physical science certification areas. See plans for details. Students are not certified to teach in a minor area. However, physical science for secondary education majors are certified to teach chemistry, earth science, and physics. All minors for secondary education require a minimum of 21 hours.

Biological Science Minor for Secondary Education (21 hours)

Required Support Courses

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3

Required for Minor

BIO 150 Principles of Biology I	3
BIO 151 Principles of Biology Laboratory I	2
BIO 152 Principles of Biology II	3
BIO 153 Principles of Biology Laboratory II	2
BIO 325 Introductory Ecology	4
BIO 304 Principles of Genetics	
or	
ABT 360 Genetics	3-4

Recommended for Minor

Additional courses selected with aid of advisor.

Chemistry Minor for Secondary Education

Required for Minor

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3

Recommended for Minor

CHE 230 Organic Chemistry I	3
CHE 231 Organic Chemistry Laboratory I	2
CHE 232 Organic Chemistry II	3
CHE 233 Organic Chemistry Laboratory II	2
CHE 226 Analytical Chemistry	3-4
or	
BCH 401G Fundamentals of Biochemistry	3

Additional courses selected with aid of advisor.

Earth Science Minor for Secondary Education*

Required for Minor

AST 191 The Solar System	3
GEO 130 Earth's Physical Environment	
or	
GEO 230 Weather and Climate	3
GLY 220 Principles of Physical Geology	4
or	
GLY 223 Introduction to Geology in the Rocky Mountains	6
GLY 230 Fundamentals of Geology I	3
GLY 235 Fundamentals of Geology II	3
GLY 360 Mineralogy	
or	
GLY 401G Invertebrate Paleobiology and Evolution	3-4

Recommended for Minor

The following list contains courses that are normally applied to the minor.

AST 192 Stars, Galaxies and the Universe	3
GLY 360 Mineralogy (if not taken above)	4
GLY 401G Invertebrate Paleobiology and Evolution (if not taken above)	3
GLY 341 Landforms	3
PLS 366 Fundamentals of Soil Science	4
Oceanography course (if transferred from another university)	3

Mathematics Minor for Secondary Education

Required for Minor

MA 113 Calculus I	4
MA 114 Calculus II	4
MA 213 Calculus III	4

Recommended for Minor

Additional courses chosen with aid of advisor. In most cases courses will be selected from the following list.

MA 341 Topics in Geometry	3
MA 310 Mathematical Problem Solving for Teachers	3
MA 261 Introduction to Number Theory	3
MA 320 Introductory Probability	3
MA 322 Matrix Algebra and Its Applications	3
MA 330 History of Mathematics	3
MA 214 Calculus IV	3

Physics Minor for Secondary Education

Required Support Course

MA 113 Calculus I	4
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Recommended Support Courses

CHE 105 General College Chemistry I	3
CHE 107 General College Chemistry II	3
CHE 115 General Chemistry Laboratory	3
MA 114 Calculus II	4

Note mathematics requirements for taking upper-level physics courses.

Required for Minor

PHY 211/213 General Physics	10
or	
PHY 231/232 General University Physics	
and	
PHY 241/242 General University Physics Laboratory	10
PHY 361 Principles of Modern Physics	3

Recommended for Minor

AST 191 The Solar System	
or	
*PHY 151 Introduction to Physics	3
AST 192 Stars, Galaxies and the Universe	
or	
*PHY 152 Introduction to Physics	3

***Note:** A maximum of six hours of astronomy may be counted toward the 21 hour physics requirement. A student may **not** count both the AST 191, 192 **and** PHY 151, 152 sequences toward the minor. If PHY 151 and PHY 152 are applied to the major, they must be completed prior to taking the PHY 231, 241, 232, 242 sequence.