Content Guidelines/Standards Matrix

College/University University of Detroit Mercy **Code** DI

Source of Guidelines/Standards Michigan State Board of Education, August 2002 **Program/Subject Area** Integrated Science (Elementary)

A – Awareness
The integrated science teacher recognizes/recalls the existence of different aspects of integrated science and related teaching strategies.

B – Basic Understanding
The integrated science teacher articulates knowledge about integrated science and related instructional and assessment strategies. The integrated science teacher demonstrates proficiency in using the knowledge at a fundamental level of competence acceptable for teaching.

C – Comprehensive Understanding
The integrated science teacher is able to apply broad, in-depth knowledge of the different aspects of integrated science in a variety of settings. (This level is not intended to reflect mastery; all teachers are expected to be lifelong learners.)

An integrated science endorsement prepares a teacher to teach integrated science at the elementary level in courses designed to meet the Michigan Curriculum Framework science standards. The preparation of integrated science teachers includes courses of study in each of the three major categories of science identified in the Michigan Curriculum Framework: Life Sciences, Physical Science, and Earth/Space Science. The Elementary Integrated Science Endorsement requires a group major with a minimum of 36 semester hours distributed among the three major categories for a balance of credits across the areas or a group minor with a minimum of 24 semester hours among the three major categories. Candidates who apply for the DI Endorsement (elementary) must pass the Michigan Test for Teacher Certification integrated science test at the elementary level for their elementary certificate.

DIRECTIONS: List required courses on matrix and provide additional narrative to explain how standards are met. If electives are included, they should be clearly indicated. Adjust size of cells as needed.

No.	Standard/Guideline **Submit a narrative that explains how this program:**	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
A.	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that elementary integrated science teachers have the content knowledge and the ability to teach this curriculum; and	**Group Minor:** BIO 120/121 General Biology I lecture/lab, and BIO122/123 General Biology II lecture/lab. CHM107 General Chemistry I, CHM110 Chemistry Lab I. GEO 211 World Regional Geography PHY108 History of the Universe, PHY130/131 General Physics I lecture/lab, and PHY132 General Physics II. The courses listed above are all designed to give students the depth and breadth of knowledge needed to become professionals in the teaching of K-8 students. As part of this review process, the instructors became familiar with the *MCF* for their disciplines.
		Group Major: BIO 103 Environmental Science, BIO 120/121 General Biology I lecture/lab, BIO 122/123 General Biology II lecture/lab, CHM 103 Chemistry in Society, CHM107 General Chemistry I, CHM108 General Chemistry II, CHM110 Chemistry Lab I, CHM111 General Chemistry Lab II, , GEO 211 World Regional Geography PHY 108 History of the Universe, PHY130 General Physics I, PHY131 Physics Lab I, PHY132 General Physics II, PHY133 General Physics Lab II. The science courses listed above are all designed to give candidates the depth and breadth of knowledge needed to become professionals in the teaching of K-8 students. As part of this review process, the instructors became familiar with the *MCF* for their disciplines.
B.	develops an understanding of the	**Group Minor:**

No.	Standard/Guideline Submit a narrative that explains how this program:	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
	interconnectedness of all science, along with major unifying themes, and relates this understanding to the teaching of science; and	The courses listed in Standard A are interwoven with connections between the sciences and to the relevance of the subject matter to everyday life. As discussed in Section A, the students continue to demonstrate their understanding of the *MCF* standards and benchmarks in their sequence of Education courses, especially in EDU 400, 441, 443, 448, 449 and during EDU 489, student teaching. Please see Standard C for a detailed discussion.
		Group Major: The courses listed in Standard are interwoven with connections between the sciences and to the relevance of the subject matter to everyday life. As discussed in Section A, the students continue to demonstrate their understanding of the *MCF* standards and benchmarks in their sequence of Education courses, especially in EDU 400, 441, 443, 448, and during EDU 489, student teaching. Please see Standard C for a detailed discussion.
C.	prepares candidates to understand and teach biology, chemistry, physics, and earth/space science as integrated content.	**Group Minor:** Education candidates are introduced to the *Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks* in EDU 400 Introduction to Education. Throughout the semester, the potential elementary Teacher Education candidates observe in a K-8 grade classroom of the major and/or minor for which they are considering certification. They conduct a field study and write up their findings as a case study. Education methods courses require that candidates use the appropriate *MCF* standards to complete projects, papers, unit and lesson plans. Elementary candidates enhance their knowledge of *MCF* standards for each of the Integrated Science disciplines in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools. The course is designed to increase students' repertoires of instructional strategies through research, classroom presentations, and building a series of portfolios with lesson plans and articles appropriate to grade levels and K-8 student abilities. Candidates are required to create lessons using the appropriate *MCF* standards and benchmarks. The directions and assessment rubrics require exact *MCF* references. In EDU 459/600 Instructional Technology the final project is an interdisciplinary team design of an authentic, technology-enriched learning activity that connects content area standards with student technology standards and meets the diverse needs of students. A science candidate works to include integrated science concepts in the interdisciplinary project. The elementary reading methods courses (EDU 443, EDU 448) also involve the candidates in creating lessons based on the *MCF*. When the candidates develop lessons to build vocabulary in K-8 students in EDU 443, science candidates may use scientific vocabulary. In EDU 448 as part of the thematic unit, candidates include lessons for language arts, mathematics, science, and social science that will enhance student learning of the themes and concepts being taught in the unit. The candidates link their lessons to the *MCF*. During Student Teaching, EDU 489 Student Teaching in the Elementary and Middle Schools, candidates work with the elementary school's curriculum and present lessons designed to help elementary students learn the concepts and skills required for them in the *MCF*.
C.	prepares candidates to understand	

No.	Standard/Guideline Submit a narrative that explains how this program:	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
(cont.)	and teach biology, chemistry, physics, and earth/space science as integrated content.	**Group Major:** Education candidates are introduced to the *Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks* in EDU 400 Introduction to Education. Throughout the semester, the potential elementary Teacher Education candidates observe in a K-8 grade classroom of the major and/or minor for which they are considering certification. They conduct a field study and write up their findings as a case study. Education methods courses require that candidates use the appropriate *MCF* standards to complete projects, papers, unit and lesson plans. Elementary candidates enhance their knowledge of *MCF* standards for each of the Integrated Science disciplines in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools. The course is designed to increase students' repertoires of instructional strategies through research, classroom presentations, and building a series of portfolios with lesson plans and articles appropriate to grade levels and K-8 student abilities. Candidates are required to create lessons using the appropriate *MCF* standards and benchmarks. The directions and assessment rubrics require exact *MCF* references. In EDU 459/600 Instructional Technology the final project is an interdisciplinary team design of an authentic, technology-enriched learning activity that connects content area standards with student technology standards and meets the diverse needs of students. A science candidate works to include integrated science concepts in the interdisciplinary work. The elementary reading methods courses (EDU 443, EDU 448) also involve the candidates in creating lessons based on the *MCF*. When the candidates develop lessons to build vocabulary in K-8 students in EDU 443, science candidates may use scientific vocabulary. In EDU 448 as part of the thematic unit, candidates include lessons for language arts, mathematics, science, and social science that will enhance student learning of the themes and concepts being taught in the unit. The candidates link their lessons to the *MCF*. During Student Teaching, EDU 489 Student Teaching in the Elementary and Middle Schools, candidates work with the elementary school's curriculum and present lessons designed to help elementary students learn the concepts and skills required for them in the *MCF*.

			Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs	
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	The preparation of elementary integrated science teachers will enable them to:			
1.0	understand and develop the major concepts and principles of biology, chemistry, earth/space science, and physics, which may include such topics as the following:			
1.1	Cellular Function, including:			
1.1.1	cell theory	B	BIO 120/ 121 General Biology I lecture/lab, foundational course with research-based lab experiences. These courses survey cell theory through readings, lecture, lab observations and experiments, discussion, and examinations to ensure that students learn about cell theory.	BIO 120/ 121 General Biology I lecture/lab, foundational course with research-based lab experiences. These courses survey cell theory through readings, lecture, lab observations and experiments, discussion, and examinations to ensure that students learn about cell theory.
1.1.2	cell types	B	BIO 122/123 General Biology II with lab. These courses survey cell types through a traditional lecture series supplemented with audio visual aids and an accompanied laboratory where students observe the biological and chemical phenomena described in the lecture to ensure that they learn about cell types.	BIO 122/123 General Biology II with lab. These courses survey cell types through a traditional lecture series supplemented with audio visual aids and an accompanied laboratory where students observe the biological and chemical phenomena described in the lecture to ensure that they learn about cell types.
1.1.3	cell structure and function	C	BIO 120/121 General Biology I with lecture/lab. These courses survey cell structure and function through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about cell structure and function.	BIO 120/121 General Biology I with lecture/lab. These courses survey cell structure and function through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about cell structure and function.

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1.1.4	protein synthesis	A	BIO 120/121 General Biology I with lecture/lab. These courses survey protein synthesis through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about protein synthesis.	BIO 120/121 General Biology I with lecture/lab. These courses survey protein synthesis through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about protein synthesis.
1.1.5	cell division (mitosis & meiosis)	A	BIO 120/121 General Biology I with lecture/lab. These courses survey cell division (mitosis & meiosis) through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about cell division.	BIO 120/121 General Biology I with lecture/lab. These courses survey cell division (mitosis & meiosis) through readings, lecture, lab observations and experiments, discussions, and examinations to ensure that students learn about cell division.
1.2	Organization of Living Things, including			
1.2.1	life cycles (including sexual and asexual reproduction)	C	BIO 120/121 &122/123 General Biology I and II lecture with labs. These courses survey reproductive cycles among all representative living groups and engage students in lectures, lab observations and activities, and examinations to ensure that students learn about life cycles.	BIO 120/121 &122/123 General Biology I & II lecture with labs. These courses survey reproductive cycles among all representative living groups and engage students in lectures, lab observations and activities, and examinations to ensure that students learn about life cycles.
1.2.2	living and non-living	C	BIO 120/121 &122/123 General Biology I and II lecture with labs. These courses engage students in lectures, lab observations/activities, and examinations to ensure that they learn about living and non –living life cycles.	BIO 120/121 &122/123 General Biology I and II lecture with labs. These courses engage students in lectures, lab observations/activities, and examinations to ensure that they learn about living and non –living life cycles.
1.2.3	systems	C	BIO 122/123 General Biology II lecture with lab. The students learn about systems through	BIO 122/123 General Biology II lecture with lab. The students learn about systems through a

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1.2.3 (cont.)	systems		a traditional lecture series supplemented with audio visual aids and an accompanied laboratory where students observe the biological and chemical phenomena described in the lecture.	traditional lecture series supplemented with audio visual aids and an accompanied laboratory where students observe the biological and chemical phenomena described in the lecture.
1.2.4	classification	B	BIO 120/121 General Biology I lecture with labs. BIO 122/123 General Biology II lecture with labs. Classification is learned through readings, lectures, discussions, and laboratory activities.	BIO 120/121 General Biology I lecture with labs. BIO 122/123 General Biology II lecture with labs. Classification is learned through readings, lectures, discussions, and laboratory activities.
1.2.5	growth and development (embryology, etc.)	A	BIO 120/121 General Biology I lectures and labs and BIO 122/123 General Biology II lecture with labs provided students with a biology foundational survey of topics such as growth and development.	BIO 120/121 General Biology I lectures and labs and BIO 122/123 General Biology II lecture with labs provided students with a biology foundational survey of topics such as growth and development.
1.2.6	photosynthesis	B	BIO 120/121 General Biology I lecture with labs teaches photosynthesis.	BIO 120/121 General Biology I lecture with labs teaches photosynthesis.
1.2.7	cellular respiration	B	BIO 120/121 General Biology I lecture with labs teaches cellular respiration.	BIO 120/121 General Biology I lecture with labs teaches cellular respiration.
1.3	Concepts of Heredity, including			
1.3.1	Mendelian genetics	B	BIO 120/121 General Biology I lecture with labs covers Mendelian genetics.	BIO 120/121 General Biology I lecture with labs covers Mendelian genetics.
1.3.2	traits passed from one generation to the next traits passed from one generation to the next	C	BIO 120/121 General Biology I lecture with labs studies traits passed from one generation to the next through lectures, labs, discussions, and analysis of the basic principles of inheritance as seen in various living forms.	BIO 120/121 General Biology I lecture with labs studies traits passed from one generation to the next through lectures, labs, discussions, and analysis of the basic principles of inheritance as seen in various living forms.

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1.3.3 1.3.3 (cont.)	molecular genetics (structure of DNA)	A	BIO 120/121 General Biology I lecture with labs studies molecular genetics (structure of DNA) by readings, lectures, discussions, and laboratory activities.	BIO 120/121 General Biology I lecture with labs studies molecular genetics (structure of DNA) by readings, lectures, discussions, and laboratory activities.
1.3.4	modern genetics (electrophoresis, genetic engineering, DNA fingerprinting, etc.)	A	BIO 120/121 General Biology I lecture with labs studies modern genetics by readings, lectures, discussions, and laboratory activities.	BIO 120/121 General Biology I lecture with labs studies modern genetics by readings, lectures, discussions, and laboratory activities.
1.3.5	environmental effects on heredity	B	BIO 120/121 General Biology I lecture with labs teaches environmental effects on heredity through readings, lectures, discussions, class activities, and laboratory experiments. Environmental effects on heredity are discussed in the effects of disease and illness due to human interaction with the environment in GEO 211 as the different world regions are studied.	BIO 120/121 General Biology I lecture with labs teaches environmental effects on heredity through readings, lectures, discussions, class activities, and laboratory experiments. Environmental effects on heredity are discussed in the effects of disease and illness due to human interaction with the environment in GEO 211 as the different world regions are studied.
1.4	Evolutionary Change, including			
1.4.1	diversity/speciation	A	BIO 120/121 General Biology I lectures with labs. BIO 122/123 General Biology II lectures with labs. Both courses study diversity/speciation by readings, lectures, discussions, and laboratory activities.	BIO 120/121 General Biology I lectures with labs. BIO 122/123 General Biology II lectures with labs. Both courses study diversity/speciation by readings, lectures, discussions, and laboratory activities.
1.4.2	theory of evolution (adaptation, variation, and natural selection and relationships	B	BIO 122/123 General Biology II (lectures and labs) studies the theory of evolution during the third through eighth sessions through readings, lectures, discussions, and classroom	BIO 122/123 General Biology II (lectures and labs) studies the theory of evolution during the third through eighth sessions through readings, lectures, discussions, and classroom and

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	between species, including human)		and laboratory activities.	laboratory activities.
1.4.3	fossils/ancient life	B	BIO 120/121 General Biology I lecture and lab and BIO 122/123 General Biology II lecture and lab cover fossils/ancient life as part of the instruction about the theory of evolution. They are also covered in GEO 211 as students study the historical geography of each world region.	BIO 120/121 General Biology I lecture and lab and BIO 122/123 General Biology II lecture and lab cover fossils/ancient life as part of the instruction about the theory of evolution. They are also covered in GEO 211 as students study the historical geography of each world region.
1.4.4	extinction	B	BIO 122/123 General Biology II lecture and lab covers extinction as part of the instruction about the theory of evolution. Extinction is discussed in GEO 211 World Regional Geography through journal articles, presentations, and discussions including causes and current efforts to prevent extinction.	BIO 122 General Biology II lecture and lab covers extinction as part of the instruction about the theory of evolution. Extinction is discussed in GEO 211 World Regional Geography through journal articles, presentations, and discussions including causes and current efforts to prevent extinction.
1.5	Ecological Systems, including			
1.5.1	community relationships, including predator/prey and symbiosis	C	BIO 120/121 General Biology I lecture and lab covers community relationships when studying evolution. BIO 122 /123 General Biology II lecture and lab also covers the topic in sessions on ecosystem, animal behavior, populations, and communities. GEO 211 World Regional Geography includes journal articles, discussions, and presentations on the effects of community relationships, predator/prey and symbiosis in relationship to the world's water and food supply.	BIO 120/121 General Biology I lecture and lab covers community relationships when studying evolution. BIO 122 /123 General Biology II lecture and lab also covers the topic in sessions on ecosystem, animal behavior, populations, and communities. GEO 211 World Regional Geography includes journal articles, discussions, and presentations on the effects of community relationships, predator/prey and symbiosis in relationship to the world's water and food supply.

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1.5.2	population	A	Population and the influences of various population of species, including humans, is studied as part of environmental concerns in courses such as GEO 211 World Regional Geography, and PHY 108 History of the Universe.	Population and the influences of various population of species, including humans, is studied as part of environmental concerns in courses such as BIO 103 Environmental Science, CHM 103 Chemistry in Society, GEO 211 World Regional Geography, and PHY 108 History of the Universe.
1.5.3	transfer of energy (food chains/webs)	C	BIO 120/121 General Biology I (lectures with labs) studies transfer of energy through lectures, labs, and discussions. Transfer of energy is also studied in CHM 107/110 General Chemistry 1 lecture and lab, PHY 108 History of the Universe, and PHY 130/131 General Physics I lecture and lab.	BIO 120/121 General Biology I (lectures with labs) studies transfer of energy through lectures, labs, and discussions. Transfer of energy is also studied in CHM 103 Chemistry in Society, CHM 107/110 General Chemistry 1 lecture and lab, CHM 108/111 General Chemistry II lecture and lab, PHY 108 History of the Universe, and PHY 130/131 General Physics I lecture and lab.
1.5.4	biogeochemical cycles	B	BIO 122/123 General Biology II lecture and lab covers biogeochemical cycles through readings, lectures, discussion, and experiments.	BIO 122/123 General Biology I lecture and lab covers biogeochemical cycles through readings, lectures, discussion, and experiments. BIO 103 Environmental Science reviews basic chemistry and relationships with biology.
1.5.5	human impact	B	The human impact on ecological systems is studied through readings, lectures, discussion, classroom activities, and laboratory investigations in the final sessions of BIO 122/123 General Biology II. GEO 211 World Regional Geography studies the human impact on the physical as well as economic, social, and political systems of each region studied.	The human impact on ecological systems is studied through readings, lectures, discussion, classroom activities, and laboratory investigations in the final sessions of BIO 122/123 General Biology II. BIO 103 Environmental Science considers the human impact on all aspects of the environment studied. GEO 211 World Regional Geography studies the human impact on the physical as well as economic, social, and political systems of each region studied.

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1.6	Human Biology, including			
1.6.1	anatomy and physiology	B	BIO 122/123 General Biology II lectures with labs. The students learn about anatomy and physiology through a traditional lecture series supplemented with audio visual aids and an accompanied laboratory.	BIO 122/123 General Biology II lectures with labs. The students learn about anatomy and physiology through a traditional lecture series supplemented with audio visual aids and an accompanied laboratory.
1.6.2	disease and immunology	A	BIO 122/123 General Biology II lectures with labs discusses disease and immunology as part of readings (Chapter 19) and lecture (February 25 in the syllabus). In GEO 211 World Regional Geography the diseases and immunology unique to each region are discussed as part of understanding the human impact on environment and health issues with specific emphasis on third world countries and the effects of endemic, epidemic, and pandemic diseases in relationship to immunology and treatment.	BIO 122/123 General Biology II lectures with labs discusses disease and immunology as part of readings (Chapter 19) and lecture (February 25 in the syllabus). In GEO 211 World Regional Geography the diseases and immunology unique to each region are discussed as part of understanding the human impact on environment and health issues with specific emphasis on third world countries and the effects of endemic, epidemic, and pandemic diseases in relationship to immunology and treatment.
1.6.3	health habits	B	BIO 122/123 General Biology II lectures with labs discusses disease and immunology as part of readings (Chapter 19) and lecture (February 25 in the syllabus). In GEO 211 World Regional Geography the health habits and their consequences unique to each region are discussed as part of understanding the human impact on environment and health issues.	BIO 122/123 General Biology II lectures with labs discusses disease and immunology as part of readings (Chapter 19) and lecture (February 25 in the syllabus). In GEO 211 World Regional Geography the health habits and their consequences unique to each region are discussed as part of understanding the human impact on environment and health issues.
1.6.4	resource management	C	Management of regional resources in relation to other regions is discussed in GEO 211 World Regional Geography as part of studying each regions environment and economic political status.	BIO 103 Environmental Science studies resource management through textbook and handout readings, lectures, discussion, and the writing of a paper analyzing a problem presented through readings and classroom activities. Management of regional resources in relation to other regions is discussed in GEO 211 World Regional Geography

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No.	**Standard/Guideline**	**Level of Proficiency**	**Group Minor**	**Group Major**
1.6.4 (cont.)	resource management			as part of studying each regions environment and economic political status.
1.6.5	human population growth and diversity	B	BIO 122/123 General Biology II lecture and lab. Each course engages the students in studying human population growth and diversity through readings, lectures, and discussions. GEO 211 World Regional Geography also analyzes human population growth and diversity as part of its regional studies.	BIO 103 Environmental Science; BIO 122/123 General Biology II lecture and lab. Each course engages the students in studying human population growth and diversity through readings, lectures, and discussions. In BIO 103, Human Population Growth and Diversity is an optional topic for the written paper. GEO 211 World Regional Geography also analyzes human population growth and diversity as part of its regional studies.
1.7	Earth/Space Science, including			
1.7.1	lithosphere and historical geology	B	PHY 108 History of the Universe covers lithosphere and historical geology by readings in the James Trefil and Robert M. Hazen textbook, *The Sciences: An Integrated Approach 4th Edition* (Chapters 16 & 17) as well as essays, articles, and other handouts provided by the instructor and located weekly by the students in print media for study and comment in their journal. Lectures, class discussions and activities, weekly homework of problems sets, and a term project ensure that students understand such concepts. CHM 103 Chemistry in Society and CHM 227/228 Organic Chemistry I lecture and lab teach a few instrumental methods (mass spectrometry, infrared spectroscopy) that could be applied to earth/space study. In	PHY 108 History of the Universe covers lithosphere and historical geology by readings in the James Trefil and Robert M. Hazen textbook, *The Sciences: An Integrated Approach 4th Edition* (Chapters 16 & 17) as well as essays, articles, and other handouts provided by the instructor and located weekly by the students in print media for study and comment in their journal. Lectures, class discussions and activities, weekly homework of problems sets, and a term project ensure that students understand such concepts. CHM 103 Chemistry in Society and CHM 227/228 Organic Chemistry I lecture and lab teach a few instrumental methods (mass spectrometry, infrared spectroscopy) that could be applied to earth/space study. In GEO 211 World

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No.	**Standard/Guideline**	**Level of Proficiency**	**Group Minor**	**Group Major**
			GEO 211 World Geography the lithosphere and historical geology of each region is touched on through readings, lectures, and map study as part of understanding the history of the region economically, politically, and socially. The physical setting is basic to understanding the regions.	Geography the lithosphere and historical geology of each region is touched on through readings, lectures, and map study as part of understanding the history of the region economically, politically, and socially. The physical setting is basic to understanding the regions.
1.7.2	hydrosphere	C	PHY 108 History of the Universe touches on the hydrosphere during the readings, lectures, discussions, and activities of week 11, "Cycles of the Earth" (hydrologic cycle). GEO 211 World Regional Geography extensively reviews and discusses the hydrosphere and the hydrologic cycle and its importance to the survival of people in world regions.	PHY 108 History of the Universe touches on the hydrosphere during the readings, lectures, discussions, and activities of week 11, "Cycles of the Earth" (hydrologic cycle). GEO 211 World Regional Geography extensively reviews and discusses the hydrosphere and the hydrologic cycle and its importance to the survival of people in world regions.
1.7.3	atmosphere, weather, climate	C	PHY 108 History of the Universe studies atmosphere, weather, and climate during the readings, lectures, discussions, and activities of week 11 (Trefil and Hazen textbook, Chapter 18, "Cycles of the Earth"). Atmosphere, weather, and climate are basic areas studied in GEO 211 World Regional Geography as each world region is analyzed.	PHY 108 History of the Universe studies atmosphere, weather, and climate during the readings, lectures, discussions, and activities of week 11 (Trefil and Hazen textbook, Chapter 18, "Cycles of the Earth"). Atmosphere, weather, and climate are basic areas studied in GEO 211 World Regional Geography as each world region is analyzed.
1.7.4	astronomy	B	PHY 108 History of the Universe introduces astronomy concepts during the first three weeks of the course ("Science: A Way of Knowing," "The Ordered Universe," "Forces and Motion") and continues the study during weeks 9 ("The Stars"), 10 ("Earth and Other Planets"), and 14 ("Cosmology"). Readings,	PHY 108 History of the Universe introduces astronomy concepts during the first three weeks of the course ("Science: A Way of Knowing," "The Ordered Universe," "Forces and Motion") and continues the study during weeks 9 ("The Stars"), 10 ("Earth and Other Planets"), and 14 ("Cosmology"). Readings, lectures,

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			lectures, discussions, and class room activities are used to facilitate student learning.	discussions, and class room activities are used to facilitate student learning.
1.8	Chemistry and Physics: Major Concepts and Principles of Physics and Chemistry			
1.8.1	Inorganic Chemistry, including			
1.8.1.1	atomic/molecular structure and bonding	B	Covered in CHM107/110 General Chemistry I lecture and lab through pre-class readings in Brady, Russell, Holum's text, *Chemistry, Matter and its Changes* and lectures. In addition to participation in class discussions and other activities, students demonstrate their understanding of the concepts and principles by their performances on randomly chosen quiz days, a mid-term examination, and a final examination. ***This explanation applies to anytime CHM 107/110 is listed in this matrix.***	Foundational concepts are introduced in CHM 103 Chemistry in Society through readings, lectures, and guest presentations. Through written reviews of guest speakers' presentations, participation in class discussions/activities, quizzes, and examinations, candidates demonstrate their knowledge. Covered in more depth by CHM107/110 General Chemistry I lecture and lab through pre-class readings in Brady, Russell, Holum's text, *Chemistry, Matter and its Changes* and lectures. In addition to participation in class discussions and other activities, students demonstrate their understanding of the concepts and principles by their performances on randomly chosen quiz days, a mid-term examination, and a final examination. ***This explanation applies to anytime CHM 107/110 is listed in this matrix.***
1.8.1.2	stoichiometry	B	Covered in CHM107 General Chemistry I when discussing organic functionality.	Covered in CHM107 General Chemistry I when discussing organic functionality.
1.8.1.3	gas laws	B	Covered in CHM107/110 General Chemistry I lecture and lab in chapter 10 of Brady, Russell, Holum.	Covered in CHM107/ 110General Chemistry I lecture and lab in chapter 10 of Brady, Russell, Holum.

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1.8.1.4	states of matter	C	Covered in CHM107/110 General Chemistry I lecture and lab in early chapters of Brady, Russell, Holum.	Covered in CHM107/110 General Chemistry I lecture and lab in early chapters of Brady, Russell, Holum.
1.8.1.5	equilibria	A	Covered in CHM108/111 General Chemistry II lecture and lab, several chapters of Brady, Russell, Holum, especially Chapter 14.	Covered in CHM108/111 General Chemistry II lecture and lab, several chapters of Brady, Russell, Holum, especially Chapter 14.
1.8.1.6	acid-bases	B	Covered in CHM107/110 General Chemistry I lecture and lab.	Covered in CHM107/110 General Chemistry I lecture and lab and CHM108/11 lecture and lab General Chemistry II.
1.8.1.7	electrochemistry	A	Covered in CHM107/110 General Chemistry I lecture and lab.	Covered in CHM107/110 General Chemistry I lecture and lab and CHM108/111 General Chemistry II lecture and lab, chapter 19 of Brady, Russell, Holum.
1.8.1.8	Nomenclature	A	CHM 107/110 General Chemistry I lecture and lab introduces scientific nomenclature and provides practice in accurate use during lectures, discussions, and classroom activities. New nomenclature is taught as appropriate in any Chemistry class. Students are expected to use the correct nomenclature in written and oral presentations.	CHM 103 Chemistry in Society and CHM 107 General Chemistry I introduce scientific nomenclature and provide practice in accurate use during lectures, discussions, and classroom activities. CHM 227/228 Organic Chemistry I lecture and lab examines nomenclature throughout the courses as a tool for understanding the uniformity of scientific language. New nomenclature is taught as appropriate in any Chemistry class. Students are expected to use the correct nomenclature in written and oral presentations.
1.8.1.9	qualitative analysis	A	Covered in CHM 107/110 General Chemistry 1 lecture and lab.	Covered in CHM 107/110 General Chemistry 1 lecture and lab. In CHM 103 students apply qualitative and quantitative methods of chemistry in the study of forensics.

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No.	**Standard/Guideline**	**Level of Proficiency**	**Group Minor**	**Group Major**
1.8.2	Physics, including			
1.8.2.1	mechanics	B	PHY 108 History of the Universe introduces mechanics when history is covered during first 2 sessions in Chapters 2 and 5. Students complete a sequence of introductory classes and laboratories including PHY 130/131 General Physics I. Galilean laws, Kepler's laws, and Newton's laws are introduced and learned through readings (J. D. Cutnell and K. W. Johnson's text *Physics 6th Edition*), home work assignments, lectures, demonstrations and laboratory experiments.	PHY 108 History of the Universe introduces mechanics when history is covered during first 2 sessions in Chapters 2 and 5. Students complete a sequence of introductory classes and laboratories including PHY 130/131 General Physics I. Galilean laws, Kepler's laws, and Newton's laws are introduced and learned through readings (J. D. Cutnell and K. W. Johnson's text *Physics 6th Edition*), home work assignments, lectures, demonstrations and laboratory experiments.
1.8.2.2	electricity and magnetism	B	PHY 108 History of the Universe introduces electricity and magnetism during Week 2-The Ordered Universe; and studies in more depth during week 3-Forces and Motion, and week 6-Waves and Electromagnetic Radiation. Electricity and magnetism are covered in PHY 132 General Physics II through lectures, demonstrations and problem solving (See Lecture Topics), and with experiments in PHY 133 General Physics II Lab (See Experiments).	PHY 108 History of the Universe introduces electricity and magnetism during Week 2-The Ordered Universe; and studies in more depth during week 3-Forces and Motion, and week 6-Waves and Electromagnetic Radiation. Electricity and magnetism are covered in PHY 132 General Physics II through lectures, demonstrations and problem solving (See Lecture Topics), and with experiments in PHY 133 General Physics II Lab (See Experiments).
1.8.2.3	Thermodynamics	A	Laws are introduced in PHY 108 History of the Universe through readings in chapters 3 and 4 of Trefil & Hazen, lectures, discussions, and classroom activities. Additional coverage is provided in CHM107/110 General Chemistry I lecture and lab as part of the study of thermochemistry, chapter 6 of Brady,	Laws are introduced in PHY 108 History of the Universe through readings in chapters 3 and 4 of Trefil & Hazen, lectures, discussions, and classroom activities. Additional coverage is provided in CHM107/110 General Chemistry I lecture and lab as part of the study of thermochemistry, chapter 6 of Brady, Russell,

			Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs	
No.	**Standard/Guideline**	**Level of Proficiency**	**Group Minor**	**Group Major**
1.8.2.3 (cont.)	Thermodynamics		Russell, Holum.	Holum. Additional coverage is provided in CHM107/110 General Chemistry I lecture and lab as part of the study of thermochemistry, chapter 6 of Brady, Russell, Holum. CHM 108/111 General Chemistry II lecture and lab also studies thermodynamics during week 12, chapter 18 of Brady, Russell, Holum.
1.8.2.4	waves, vibrations, and optics	B	PHY 108 History of the Universe introduces wave, vibrations, and optics during week six of the course (Chapter 6 of Trefil & Hazen) and again during the study of earthquakes as part of the study of plate tectonics during Week 11 (Chapter 17). Waves, vibrations, and optics are also studied at the end of mechanics study just before fluids in Trefil and Hazen (Chapter 10) during the final two weeks of PHY 130/131 General Physics I lecture and lab.	PHY 108 History of the Universe introduces wave, vibrations, and optics during week six of the course (Chapter 6 of Trefil & Hazen) and again during the study of earthquakes as part of the study of plate tectonics during Week 11 (Chapter 17). Waves, vibrations, and optics are also studied at the end of mechanics study just before fluids in Trefil and Hazen (Chapter 10) during the final two weeks of PHY 130/131 General Physics I lecture and lab.

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	The preparation of elementary integrated science teachers will enable them to:	
2.0	apply mathematics, including statistics, to investigations in the sciences, including the analysis of data;	**Group Minor and Group Major:** Students perform these activities throughout their academic careers at UDM. BIO 120/121 General Biology I (lecture with lab) uses quantitative mathematical analysis (homework assignments, in-class experiments and exercises, projects, papers, exams) with a variety of biology/life topics. For the Integrated Science majors, BIO 103 Environmental Science is a topic-oriented course providing environmental information for making intelligent choices for scientific, social, political and economic issues. Mathematics, including statistics, is applied as appropriate to analyses and discussion within topics. Readings from the textbook (P. H. Raven and L. R. Berg, *Environment 3rd Edition*) and the course web site also include application of mathematics. Lectures, weekly quizzes, a written paper, and final examination also ensure that students learn and can apply mathematics. CHM 107/110 General Chemistry I lecture and lab. These Chemistry courses include the application of qualitative and quantitative analysis to problems. The students demonstrate their ability to do so through home work problems, class discussions, quizzes, laboratory experiments, logs, written papers, and examinations The physics courses require the application of mathematics to investigations in physics. While learning the role of the scientific process in explaining the history of the universe in PHY 108 History of the Universe, students use simple algebra, proportions, and other data such as statistics to complete assignments: homework problems, readings, classroom activities, projects, quizzes, and examination. PHY 130/131 General Physics I lecture and lab; PHY 132 General Physics II lecture. These lecture and laboratory courses both require extensive use of calculation, measurement, equations, and other mathematics in written and on line homework and class assignments as well as in classroom discussions and laboratory experiments about dynamics, energy, fluids, motion, principles and laws of physics etc. Education courses continue the candidates' development of their ability to analyze data to inform their teaching practices. In EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools and EDU 449 Methods and Materials of Instruction for Mathematics in Elementary and Middle Schools, their projects and papers must include demonstration of their use of data for teaching (apply mathematics to investigations) and assessing their grades K-8 students. The "Class Schedule" identifies topics and reading assignments in the textbook *Science and Science Teaching: Methods for Integrating Technology*

No.	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
2.0 (cont.)	apply mathematics, including statistics, to investigations in the sciences, including the analysis of data;	*in Elementary and Middle Schools, 2nd Edition* by S. Sherman and R. Sherman (2003). During the first four sessions (Chapters 1-4) candidates learn the basics of constructivist and inquiry based instruction through the readings, participation in activities and/or experiments appropriate to various elementary classrooms, and reflective discussions about how such instructional strategies help children learn science. Mathematics and technology are integrated into those lessons and the others demonstrated by candidates and the instructor during the course. Specific strategies for incorporating mathematics (measurement, graphs etc) into science lessons are covered during the sixth session (Chapter 5), "Using Science Process." Throughout the course candidates design, present, and critique each other's lessons and unit plans modeled after the examples from the text and classroom activities. EDU 459 Instructional Technology provides an additional opportunity to demonstrate the ability to apply mathematics to scientific investigations through a cross disciplinary authentic, technology-enriched learning activity that connects content area standards with student technology standards and meets the diverse needs of students. During their Student Teaching (EDU 489), candidates demonstrate their ability to integrate content across disciplines and are evaluated by themselves, Cooperating Teacher, and University Supervisor on their effectiveness.

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3.0	relate the study of science to contemporary, historical, technological, and societal issues; in particular, relate the concepts of science to current controversies such as cloning, genetically-modified food, the use of energy, exploitation of resources, global changes, and medical research, as well as other issues;	**Group Minor and Major:** Students relate biology, chemistry, earth/space, and physics to contemporary, historical, technological, and societal issues though readings, discussions, and projects and experiments in their science content classes and by participating in panel discussions and lectures from outside speakers during college and university sponsored events. Some examples: In BIO 120, students participate in a service learning project at the Detroit Science Center under the direction of UDM's Leadership Development Institute. In BIO 122/123 General Biology II students reach an understanding of humans' place in the ecosystem. For Integrated Science majors, BIO 103 Environmental Science students read articles out of popular literature that relate to class issues and write a paper that analyzes the articles. They also discuss how the environmental issues impact human beings and communities. CHM 110 General Chemistry I Lab involves students in analysis of food products. In GEO 211 World Regional Geography, students read and review articles about topics such as diseases of Africa and free trade with China in which they discuss the impact of the news on the global world. In PHY 108 History of the Universe students keep a weekly journal in which they discuss articles about science and technology relevant to every day life. As the discovery of new scientific concepts reaches the public (e.g. pharmaceutical) and implementation (e.g. animal cloning, bio-chemical attacks) occurs, they impact society, the schools, and what is taught to elementary and secondary students. Candidates study the impact of such issues on school finance and curriculum through the interactive lecture and discussion format of EDU 440 School and Society. Such study facilitates the candidates' understanding of the connection between scientific concepts and current human/world issues. Candidates learn how to create lessons and experiments to engage elementary children in learning the connection of science to the real world in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools. While Chapter 9 in Sherman and Sherman focuses on teaching real world connections, it is integral to any of the activities and projects the candidates learn, design, present, and discuss. During their Student Teaching (EDU 489), candidates demonstrate their ability to correlate life experiences into areas of learning.

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4.0	locate appropriate resources, design and conduct inquiry-based open-ended scientific investigations, interpret findings, communicate results, and make judgments based on evidence;	**Group Minor and Major:** The laboratory experiences encountered during the biology, chemistry, and physics introductory and general lecture/laboratory courses provide students with ample opportunities to conduct inquiry-based investigations. In BIO 121, students are required to write their experiments on the exercise sheets in their manuals. The experiment on cold acclimation must be written as a formal lab report according to a rubric. In addition to the series of labs, students complete four practical exams in which they are tested relating to the experiments performed and laboratory tasks learned. Introduced in CHM110, General Chemistry Lab I. Students are required to keep notes for every experiment conducted in a permanent notebook, which is checked regularly for completion. Every lab is written up as a one-page separate report following the standard lab report format. Two are checked for corroboration in the notebook. Quizzes are also completed to demonstrate further the students understanding of inquiry-based open-ended investigations. By learning these skills and designs for conducting inquiry-based open-ended scientific investigations, students are prepared to function effectively at a laboratory bench and to design original investigations. In PHY 131 General Physics I Lab students conduct a series of experiments following a standard lab report format. Biology, Chemistry, and Physics classes engage students in traditional lab exercises and include open ended experiment/inquires at various points of insight. Such activities give students the foundation in inquiry based science skills necessary to teach elementary students scientific concepts and laboratory skills. The Education Department's "Conceptual Framework" clearly states that all graduates will be life long learners and professional educators who are scholars, inquirers, and ethical professionals. The "Framework" guides the Teacher Education program and courses. Throughout the Education program, candidates conduct research, interpret findings, use the data to make judgments, and communicate their results in written and oral presentations. They learn how to teach the concepts and skills of this standard in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools through readings from the Sherman and Sherman textbook, studying various lab designs from the book and web sources, presenting experiments to peers in the class, and discussing/evaluating a variety of grade level appropriate experiments. They learn how to locate and use resources, set up procedures, and kinds of questions to ask at various times in the process. Chapter 4 "Inquiry and Discovery," Chapter 2 "Instructional Technology Basics," and Chapter 5 "Using Science Processes" are key to developing the ability to design and conduct scientific investigations, but the skills are infused into other sections such as Chapter 8 "Collaboration and Cooperation" and Chapter 11 "Design-Based Learning." During their Student Teaching (EDU 489) candidates demonstrate these skills and are evaluated on their effectiveness by themselves, the K-8 Cooperating Teacher, and University Supervisor.

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5.0	construct new knowledge for themselves through research, reading and discussion, and reflect in an informed way on the role of science in human affairs;	**Group Minor and Major:** The laboratory experiences at UDM have been designed with the results of published scientific research in mind and thinking in an informed way about the role of science in human affairs. For Integrated Science majors, BIO 103 Environment Science lecture is a topic-oriented course providing environmental information for making intelligent choices for scientific, social, political and economic issues. CHM 107/110 General Chemistry I lecture and laboratory engages students in discussions about the role of science in human affairs as the various topics are presented through readings, lectures, class activities, and laboratory investigations. PHY 108 History of the Universe focuses the first week on the scientific method (Chapter 1 “Science: A Way of Knowing" in Trefil and Hazen) and applies the procedures throughout the course’s weekly journal writings about science articles and the topic’s application to life, readings, lectures, discussions, term project, quizzes, and examinations. GEO 211involves students in field research on the internet, print readings, discussions, and class individual and group activities. Students analyze economic activities in world regions in terms of geographic influences, human interactions with the environment, and aspects of interdependence among world regions. The skills learned in the100 level Biology, Chemistry, Geography, Physics classes and laboratories are effectively adaptable to the work of teachers. Education faculty members require their students to construct new knowledge for themselves through research, reading and discussion and to reflect upon their practice. These qualities are required in Education class room discussions, presentations, projects, and curriculum, unit, lesson planning, papers, and presentations. Again, teaching constructivist methods permeates the methods course (EDU 441), with direct and hands on instruction particularly focused on understanding how children learn during week four (Chapter 4 “How Children Learn” in Sherman and Sherman) and during week 10 (Chapter 9 “Real World Connections” Sherman and Sherman) on the role of science in human affairs. During their Student Teaching (EDU 489) candidates demonstrate these skills and are evaluated on their effectiveness by themselves, the K-8 Cooperating Teacher, and University Supervisor.

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6.0	understand and promote the maintenance of a safe science classroom as identified by the Council of State Science Supervisors, including the ethical and appropriate use and care for living organisms and scientific equipment, and the safe storage, use, and disposal of chemicals;	**Group Minor:** Safe laboratory procedures are explained during the first session of any Biology, Chemistry, and Physics laboratory course and verbally reinforced at the beginning of each laboratory session. Signs throughout the labs reinforce these safe practices with scientific equipment and the safe storage, use and disposal of chemicals. Teacher Education candidates will see the qualities of a safe classroom during the field study/case study project in EDU 400 Introduction to Education when they spend time in a K-8 grade classroom of their major and/or minor. Each of the Elementary Methods courses (EDU 441-Science, 442-Social Science, 443-Reading, 448-Reading and Language Arts, 449-Mathematics) includes study of classroom leadership/management that enhance the candidates' ability to provide safe classrooms. The unique requirements for safety in a science classroom and/or laboratory are studied and demonstrated in the science methods course, EDU 441. For example, during week three when basic instructional technology is studied, keeping children safe while using the internet is discussed. During week 10, which connects the real world with science, safety with animals in the classroom is a topic. While the Council of State Science Supervisors' document is not referenced specifically in the syllabus, candidates will use it as they design lessons/units that must reference the *Michigan Curriculum Framework'*s bench marks for science. During their Student Teaching experience, candidates follow and enforce the policies of the school to which they are assigned.

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7.0	demonstrate competence in the practice of teaching as defined within the Entry Level Standards for Michigan Teachers;	**Group Minor and Major:** The *Entry-Level Standards for Michigan Teachers* (*ELSMT*) is one of the resources that were used when the Education Program and courses were designed. It continues to be referenced as the methods courses are taught and revised. In EDU 400 Introduction to Education, candidates are introduced to the Department's *Conceptual Framework* and Education goals for their candidates. They use them as guides as they reflect on a life in teaching and complete their action research based on observations, activities, and interviews in a K-8 district and classroom. In Education core courses such as EDU 420 Education Philosophy and EDU 440-School and Society candidates reference MDE guidelines in their discussions and written and oral assignments. EDU 432 Psychology of Education requires candidates to demonstrate teaching skills that reflect both *MCF* and ELSMT guidelines in K-8 tutorial settings and in the university classroom. SED 460 Education and Mainstreaming of Exceptional Persons also requires candidates to reference them in their adaptive lesson plan and presentation and other assignments. The general elementary methods courses, such as EDU 459-Instructional Technology and EDU 443 Teaching Reading in the Elementary and Middle Schools, require candidates to design and present instructional strategies specific to their disciplines and to reference state standards and benchmarks, including ELSMT. *MCF* is correlated with the ELSMT, so Education candidates also reference it as they develop lessons and units built around the specific K-8 standards and bench marks in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools, especially for their portfolio assignments. As part of this state review process, an Education committee compared the final evaluation forms used to evaluate candidates' performances during Student Teaching (EDU 489) with the MDE "Criteria for an Assessment of Pedagogy." The members agreed that the forms continue to be complementary with the ELSMT and identified criteria such as use of technology and classroom management skills that may need enhancement in future editions.

No.	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
8.0	create and maintain an educational environment in which conceptual understanding will occur for all science students;	**Group Minor and Major:** Once again, Education candidates enter the Education program with these conceptual understandings. By design diversity issues are included in the Education courses. Candidates are required to design lesson/unit plans that speak to the experiences and abilities of all students regardless of gender, socio-economic status, ethnicity, and special needs. In EDU 432 Psychology of Education, candidates learn various theories of child growth and development and use them to analyze their K-8 classroom observations, in class cooperative learning experiences, and supervised clinic tutoring experiences; and to discuss their application in the K-8 classroom as part of their final paper. In SED 460 Education and Mainstreaming of Exceptional Persons, the principles of mainstreaming and the instructional methodologies and approaches to meet the needs of the various exceptionalities within the "least restrictive environment" and/or general classroom setting are examined and explored. The candidates develop and present to the class a lesson plan adapted for at risk/special education students. Integrated Science students would present a lesson dealing with teaching science concepts. During their subject specific methods courses (EDU 442-Social Science, 443-Reading, 448-Reading and the Language Arts, 449-Mathematics) candidates read, study model lessons and demonstrations, and present individually and collaboratively developed lessons unique to each subject area that address the special needs of all students regardless of ability and other characteristics. Candidates learn how to create and maintain a positive classroom environment for conceptual understanding of science principles and skills by grades K-8 students in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools. Creating and maintaining a classroom environment in which conceptual understanding will occur for all science students is basic to constructivist methods and the topics covered in EDU 441 through lecture, discussion, research, readings, and the strategies studied and practiced from the Sherman and Sherman textbook. The science instructional strategies studied during week 8 (Chapter 7 "Science in the Diverse Classroom") are particularly helpful for this teaching standard. During the candidates' Student Teaching experience (EDU 489) candidates are regularly evaluated by themselves, their K-8 Cooperating Teacher, and the University Supervisor on their ability to provide for individual differences and for diverse and special needs (*Student Teaching Handbook* appendices on web site).

No.	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Elementary Programs
9.0	develop an understanding and appreciation for the nature of scientific inquiry; and	**Group Minor and Major:** The classroom activities and laboratory experiences in the Biology, Chemistry, and Physics courses are designed to promote inquiry-based investigations and appreciation for the scientific method. Integrated Science candidates begin their Education program with this understanding and mind set about the nature of scientific inquiry. The assignments, projects, presentations, discussions, and other instructional practices in the Education courses continue the candidates' involvement in scientific inquiry and how to help elementary and middle school age students learn and appreciate the nature of scientific inquiry. During their student teaching (EDU 489), Integrated Science candidates are evaluated on this standard as part of the "Applies appropriate classroom management skills" "Utilizes creative judgment in the teaching process" indicators. (The forms are in the appendices of the *Student Teaching Handbook* on the web site.) Please see the responses in the science content standards (1.0 – 1.8.2.4) and standards 4 and 5.

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10.0	demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific process and in assessing student learning through multiple processes.	**Group Minor and Major:** The mixture of lecture, lab, small group learning, problem solving, library research, technology based research, and student presentations in the Biology, Chemistry, Geography, and Physics courses demonstrates that candidates reach the Education program having experienced these principles in their science courses. As explained previously in Standards 4, 5, and 9, candidates demonstrate their competence in the practice of teaching through investigative experiences in EDU 441 Methods and Materials of Instruction for Science in Elementary and Middle Schools and during EDU 489 Student Teaching. Assessment practices are also addressed in EDU 432 Psychology of Education and in SED 460 Education and Mainstreaming of Exceptional Persons. Assessing student learning through multiple processes is part of each elementary methods course (EDU 441-Science, 442-Social Sciences, 443-Reading, 448-Reading and the Language Arts, 449-Mathematics). Both concepts of this standard are taught, practiced, discussed, and evaluated throughout the EDU 441 course, particularly as part of session 7 "Planning Lessons" (Chapter 6 of Sherman and Sherman). Candidates learn multiple assessment processes such as: writing objectives that will be tested, preparing questions to ask students as they construct their own learning, designing student self evaluation sheets, writing rubrics for evaluating student experiments, and writing traditional quiz and examination items (Bloom's Taxonomy). During their Student Teaching experience (EDU 489) candidates are involved in the assessment practices of the assigned classroom and K-12 Cooperating Teacher and are evaluated on their effective use of a variety of assessment practices and their ability to communicate the information to students and parents.