Content Guidelines/Standards Matrix

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

Source of Guidelines/Standards	Michigan State Board of Education, August 2002	**Program/Subject Area**	Chemistry

Levels of proficiency are identified as follows:

A – Awareness

The chemistry teacher recognizes/recalls the existence of different aspects of chemical science and related teaching strategies.

B – Basic Understanding

The chemistry teacher articulates knowledge about chemical science and related instructional and assessment strategies. The chemistry teacher demonstrates proficiency in using the knowledge at a fundamental level of competence acceptable for teaching.

C – Comprehensive Understanding

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

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.

	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program
	Submit a narrative that explains how this program:	
A.	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that chemistry teachers have the content knowledge and the ability to teach this curriculum; and	**Secondary Minor** CHM107 General Chemistry I, CHM108 General Chemistry II, CHM110 Chemistry Lab I, CHM111 General Chemistry Lab II, CHM227 Organic Chem I, CHM228 Chem Lab III, CHM470 Basic Biochemistry or CHM471 Biochemistry, CHM472 Biochemistry, CHM474 Special Topics in Biochemistry, or CHM 429 Industrial Chemistry, or CHM103 Chemistry in Society are all designed to give students the depth and breadth of knowledge needed to become professionals in their field, including in the teaching of K-12 students. Education students are introduced to the *Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks* in EDU 401/402 Introduction to Elementary and Secondary Education. Throughout the semester, the Secondary Teacher Education students observe in a 9-12 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 courses require students to use the appropriate *MCF* standards to complete projects, papers, unit and lesson plans. Candidates with a Chemistry minor will enhance their knowledge of science standards in *MCF* in EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools. The course is designed to increase students' repertoires of instructional strategies. Among the assignments, students are required to create lessons using the appropriate *MCF* standards and benchmarks. The directions and assessment rubrics require exact *MCF* references. Additional opportunities for Chemistry minors to work with the *MCF* occur in EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. Students write papers, make presentations, and create projects, units and lesson plans that must reference the appropriate *MCF* sections. During Student Teaching, EDU 490 Student Teaching in the Secondary Schools, students are expected to work with the secondary school's curriculum and present lessons designed to help secondary students learn the concepts and skills required for them in the MCF.

	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program
	Submit a narrative that explains how this program:	
A. (cont.)	uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that chemistry teachers have the content knowledge and the ability to teach this curriculum; and	**Secondary Major**: CHM107 General Chemistry I, CHM108 General Chemistry II, CHM110 Chemistry Lab I, CHM111 General Chemistry Lab II, CHM227 Organic Chem I, CHM228 Chem Lab III, CHM229 Organic Chem II, CHM230 Chem Lab IV, CHM341 Chemical Thermodynamics, CHM342 Chemical Dynamics and Quant, CHM333 Physical Chem Lab I, CHM334 Physical Chemistry Lab II, CHM387 Quantitative Analysis, CHM470 Basic Biochemistry or CHM471 Biochemistry, CHM472 Biochemistry, CHM474 Special topics in Biochemistry, or CHM 429 Industrial Chemistry, or CHM103 Chemistry in Society, MTH141 Analytic Geometry & Calculus I, MTH142 Analytic Geometry & Calculus II, PHY130 General Physics I, PHY131 Physics Lab I, PHY132 General Physics II, PHY133 General Physics Lab II are all designed to give students the depth and breadth of knowledge needed to become professionals in their field, including in the teaching of K-12 students. Education students are introduced to the *Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks* in EDU 401/402 Introduction to Elementary and Secondary Education. Throughout the semester, the Secondary Teacher Education students observe in a 9-12 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 courses require students to use the appropriate *MCF* standards to complete projects, papers, unit and lesson plans. Candidates with a Chemistry major will enhance their knowledge of science standards in *MCF* in EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools. The course is designed to increase students' repertoires of instructional strategies. Among the assignments, students are required to create lessons using the appropriate *MCF* standards and benchmarks. The directions and assessment rubrics require exact *MCF* references. Additional opportunities for Chemistry majors to work with the *MCF* occur in EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. Students write papers, make presentations, and create projects, units and lesson plans that must reference the appropriate *MCF* sections. During Student Teaching, EDU 490 Student Teaching in the Secondary Schools, students are expected to work with the secondary school's curriculum and present lessons designed to help secondary students learn the concepts and skills required for them in the MCF.

	Standard/Guideline	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program
	Submit a narrative that explains how this program:	
B.	develops an understanding of the interconnectedness of all science, including biology, the earth/space sciences, and physics, and relates this understanding to the teaching of chemistry.	**Secondary Minor:** The courses listed above, especially those above the 100-level, are interwoven with connections between the sciences, and to the relevance of the subject matter to everyday life. Higher level courses routinely involve at least one presentation by students to their peers and the teaching faculty member. 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 401.402, 469, 475, and during their student teaching.
		Secondary Major: The courses listed above, especially those above the 100-level, are interwoven with connections between the sciences, and to the relevance of the subject matter to everyday life. Higher level courses routinely involve at least one presentation by students to their peers and the teaching faculty member. 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 401.402, 469, 475, and during their student teaching.

No.	Standard/Guideline	Level of Proficiency	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
			Secondary Minor	Secondary Major
	The preparation of chemistry teachers will enable them to:			
1.0	**understand and develop the major concepts and principles of chemistry, including concepts in inorganic, organic, analytical, physical, and biochemistry, which shall include such topics as the following:**			
1.1	Inorganic Chemistry, including			
1.1.1	atomic and molecular structure and bonding	C	Covered in general chemistry, CHM107 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 is listed in this matrix.***	Covered in general chemistry, CHM107 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 is listed in this matrix.***
1.1.2	stoichiometry	C	Covered in general chemistry, CHM107, when discussing organic functionality.	Covered in general chemistry, CHM107, when discussing organic functionality.
1.1.3	thermodynamics and thermochemistry	C	Covered in general chemistry, CHM107, chapter 5 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 5 of Brady, Russell, Holum.
1.1.4	gas laws	C	Covered in general chemistry, CHM107, chapter 10, of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 10, of Brady, Russell, Holum.

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			Secondary Minor	Secondary Major
1.1.5	states of matter	C	Covered in general chemistry, CHM107, early chapters of Brady, Russell, Holum.	Covered in general chemistry, CHM107, early chapters of Brady, Russell, Holum.
1.1.6	equilibria	C	Covered in general chemistry, CHM108, several chapters of Brady, Russell, Holum.	Covered in general chemistry, CHM108, several chapters of Brady, Russell, Holum.
1.1.7	acid-base	C	Covered in general chemistry, CHM107 and CHM108.	Covered in general chemistry, CHM107 and CHM108.
1.1.8	electrochemistry	C	Covered in general chemistry, CHM108, chapter 19 of Brady, Russell, Holum.	Covered in general chemistry, CHM108, chapter 19 of Brady, Russell, Holum.
1.1.9	nomenclature	B	Covered in general chemistry, CHM107, chapter 2 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 2 of Brady, Russell, Holum.
1.1.10	qualitative analysis	C	Covered in general chemistry, CHM107, in parts of several chapters of Brady, Russell, Holum.	Covered in general chemistry, CHM107, in parts of several chapters of Brady, Russell, Holum.
1.2	Organic Chemistry, including			
1.2.1	functional groups	C	Introduced in CHM107, general chemistry. CHM 227 and 228 – functional group recognition and reactivity is the cornerstone of our organic chemistry courses and as such, is covered on every homework assignment, quiz, and examination.	Introduced in CHM107, general chemistry. CHM 227, 228, 229 and 230 - functional group recognition and reactivity is the cornerstone of our organic chemistry courses and as such, is covered on every homework assignment, quiz, and examination.
1.2.2	Nomenclature	C	CHM 227 and 228 – nomenclature is examined throughout the courses as a tool for understanding the uniformity of scientific language.	CHM 227, 228, 229 and 230 - nomenclature is examined throughout the courses as a tool for understanding the uniformity of scientific language.

No.	Standard/Guideline	Level of Proficiency	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
			Secondary Minor	Secondary Major
1.2.3	aliphatic and alicyclic reactions	A	CHM 227 and 228 – all major classes of aliphatic and alicyclic reactions (substitution, elimination, addition, radical, pericyclic) are discussed in our courses.	CHM 227, 228, 229 and 230 - all major classes of aliphatic and alicyclic reactions (substitution, elimination, addition, radical, pericyclic) are discussed in our courses.
1.2.4	stereochemistry	A	In CHM 227 and 228, stereochemistry is discussed with emphasis on its importance to the pharmaceutical industry and biochemistry. This is also covered in CHM 470 and CHM 471 when discussing amino acids and carbohydrates.	In CHM 227, 228, 229 and 230 - stereochemistry is discussed with emphasis on its importance to the pharmaceutical industry and biochemistry. This is also covered in CHM 470 and CHM 471 when discussing amino acids and carbohydrates.
1.2.5	structure and reactivity of major functional groups	B	Covered in general chemistry, CHM107, chapter 8 of Brady, Russell, Holum. CHM 227 and 228 – understanding in this area is a major objective of our course structure and as such is covered on every assignment, quiz, and exam.	Covered in general chemistry, CHM107, chapter 8 of Brady, Russell, Holum. CHM 227, 228, 229 and 230 - understanding in this area is a major objective of our course structure and as such is covered on every assignment, quiz, and exam.
1.2.6	aromatic compounds	B	Covered in general chemistry, CHM107, chapter 8 of Brady, Russell, Holum. CHM 227 and 228 – the difference between aliphatic and aromatic compounds is learned mechanistically by examining the different reactions possible with these classes of molecules.	Covered in general chemistry, CHM107, chapter 8 of Brady, Russell, Holum. CHM 227, 228, 229 and 230 - the difference between aliphatic and aromatic compounds is learned mechanistically by examining the different reactions possible with these classes of molecules.

No.	Standard/Guideline	Level of Proficiency	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
			Secondary Minor	Secondary Major
1.2.7	spectroscopy	B	CHM 227 and 228 – all major spectroscopic techniques are covered in our course structure (mass spectrometry, infrared spectrophotometry and nuclear magnetic resonance spectroscopy).	CHM 227, 228, 229 and 230 - all major spectroscopic techniques are covered in our course structure (mass spectrometry, infrared spectrophotometry and nuclear magnetic resonance spectroscopy).
1.2.8	heterocyclic compounds	A	CHM 227 and 228 – heterocyclic compounds, with special emphasis on their importance to nature are discussed.	CHM 227, 228, 229 and 230 - heterocyclic compounds, with special emphasis on their importance to nature are discussed.
1.2.9	polymers	A	CHM 227 and 228 – polymers and the monomers that they consist of are studied in regard to the reactions that generate these synthetic molecules.	CHM 227, 228, 229 and 230 - polymers and the monomers that they consist of are studied in regard to the reactions that generate these synthetic molecules.
1.2.10	bromolecules	A	CHM 227 and 228 – biomolecules (proteins, lipids, carbohydrates, nucleic acids, and cofactors) are used as standards for functional group reactivity and the ordered character of nature.	CHM 227, 228, 229 and 230 - biomolecules (proteins, lipids, carbohydrates, nucleic acids, and cofactors) are used as standards for functional group reactivity and the ordered character of nature.
1.3	Physical Chemistry, including			
1.3.1	chemical thermodynamics	B	Covered in general chemistry, CHM107 and CHM108, chapter 6 and 18 of Brady, Russell, Holum.	Covered in general chemistry, CHM107 and CHM108, chapter 6 and 18 of Brady, Russell, Holum. CHM 341 teaches fundamental laws of thermodynamics and applications specific to chemistry, chemical potentials, state functions, and changes in state functions during chemical reactions.

No.	Standard/Guideline	Level of Proficiency	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
			Secondary Minor	Secondary Major
1.3.2	thermochemistry	B	Covered in general chemistry, CHM107, chapter 6 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 6 of Brady, Russell, Holum. CHM 341 teaches fundamental laws of thermodynamics and applications specific to chemistry, chemical potentials, state functions, and changes in state functions during chemical reactions.
1.3.3	electrolyte solutions	B	Covered in general chemistry, CHM107, chapter 4 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 4 of Brady, Russell, Holum. CHM 341-ionic strength, Debye-Huckel models of chemical potentials of solutes.
1.3.4	measurements of physical properties of solids, liquids, and gases	C	Covered in general chemistry, CHM107, chapter 11 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 11 of Brady, Russell, Holum. CHM 333/343 physical chemistry laboratory.
1.3.5	phase equilibria	C	Covered in general chemistry, CHM107, chapter 11 of Brady, Russell, Holum.	Covered in general chemistry, CHM107, chapter 11 of Brady, Russell, Holum. CHM 341 -thermodynamics of phase transitions, phase equilibria, phase diagrams. CHM 333/343-phase diagrams Phase equilibria, equilibria of solutes between immiscible phases.
1.3.6	molecular spectra	B	CHM 108 General Chemistry II introduces molecular spectra. CHM 228 Organic Chemistry I Laboratory reinforces the concept.	CHM 108 General Chemistry II introduces molecular spectra. CHM 228 Organic Chemistry Laboratory reinforces the concept. CHM 342 theory of UV, IR, and microwave spectroscopy, magnetic resonance spectroscopy. CHM 334/344- UV and fluorescence spectra of conjugated systems.

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1.3.7	spectroscopy	B	Introduced in general chemistry, CHM107, chapter 7 of Brady, Russell, Holum.	Introduced in general chemistry, CHM107, chapter 7 of Brady, Russell, Holum. CHM 342 theory of UV,IR, and microwave spectroscopy, magnetic resonance spectroscopy CHM 334/344-physical chemistry laboratory-UV and fluorescence spectra, Electron Spin Resonance spectroscopy.
1.3.8	calorimetry	C	CHM 107 General Chemistry I introduces the theory and provides some practice.	CHM 107 General Chemistry I introduces the theory and provides some practice. CHM 341-theories and applications of heat transfer/calorimetry.
1.3.9	quantum mechanics	C	CHM 107 General Chemistry I introduces the theory and provides some practice.	CHM 107 General Chemistry I introduces the theory and provides some practice. CHM 342 - theory of quantum mechanics including stationary states, properties of wave functions, radiative transitions. CHM 334/344-laboratory-applications of quantum mechanics (spectroscopy).
1.4	Biochemistry, including			
1.4.1	biomolecules – proteins, lipids, carbohydrates, nucleic acids – their structure and function	C	In CHM 470 these topics are covered in lecture, homework assignments, projects, and exams as explained in the syllabus.	In CHM 470 and CHM 471 these topics are covered in lecture, homework assignments, projects, and exams as explained in the syllabus.
1.4.2	aqueous solutions	B	In CHM 470, the topic is covered in lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 472, the topic is covered in lecture, homework assignments, and exams as explained in the syllabus.
1.4.3	buffers	B	In CHM 470 this topic is covered in lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 471, this topic is covered in lecture, homework assignments, and exams as explained in the syllabus.

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1.4.4	enzyme kinetics	B	In CHM 470 this topic is covered in lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 471, this topic is covered in lecture, homework assignments, and exams as explained in the syllabus.
1.4.5	thermodynamics	B	In CHM 470, this and bioenergetics is covered in lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 471, this and bioenergetics is covered in lecture, homework assignments, and exams as explained in the syllabus.
1.4.6	electron transport	B	In CHM 470 this subject is covered in lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 471 this subject is covered in lecture, homework assignments, and exams as explained in the syllabus.
1.4.7	oxidative phosphorylation	B	In CHM 470 this is covered covers lecture, homework assignments, and exams as explained in the syllabus.	In CHM 470 and CHM 471 this is covered covers lecture, homework assignments, and exams as explained in the syllabus.
1.4.8	metabolism	B	In CHM 470 metabolism is covered in lecture, homework assignments, projects, and exams as explained in the syllabus.	In CHM 470 and CHM 472 metabolism is covered in lecture, homework assignments, projects, and exams as explained in the syllabus.
1.4.9	biosynthesis/biodegradation pathway	B	CHM 470 covers these pathways in lecture, homework assignments, projects, and exams as explained in the syllabus.	CHM 470 and CHM 472 covers these pathways in lecture, homework assignments, projects, and exams as explained in the syllabus.

No.	Standard/Guideline	Level of Proficiency	Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
			Secondary Minor	Secondary Major
1.5	Analytical Chemistry, including			
1.5.1	ionic equilibria	C	Covered in general chemistry, CHM108, chapters 13-18 of Brady, Russell, Holum through pre-class readings in the text, lectures, and classroom discussion. Copies of a solutions manual and study guide are held on reserve in the library or can be purchased to assist the students' self study. Graphing/programmable calculators are used regularly by the students except during quizzes or examinations. Students demonstrate their understanding of such Chemistry concepts through their completion of homework and an out of class project about a scientist, participation in class lectures, discussions, and their performances on quizzes and three examinations. ***This explanation applies to anytime CHM 108 is mentioned in this matrix.***	Covered in general chemistry, CHM108, chapters 13-18 of Brady, Russell, Holum Covered in general chemistry, CHM108, chapters 13-18 of Brady, Russell, Holum through pre-class readings in the text, lectures, and classroom discussion. Copies of a solutions manual and study guide are held on reserve in the library or can be purchased to assist the students' self study. Graphing/programmable calculators are used regularly by the students except during quizzes or examinations. Students demonstrate their understanding of such Chemistry concepts through their completion of homework and an out of class project about a scientist, participation in class lectures, discussions, and their performances on quizzes and three examinations. ***This explanation applies to anytime CHM 108 is mentioned in this matrix.***
1.5.2	electrochemistry	B	Covered in general chemistry, CHM108, chapter 19, of Brady, Russell, Holum.	Covered in general chemistry, CHM108, chapter 19, of Brady, Russell, Holum.
1.5.3	advanced separation technique – GLC and HPLC	B	Through lecture and class discussion in CHM 228 Organic Chemistry I Laboratory, advanced separation technique theory is studied.	Through lecture and class discussion in CHM 228 Organic Chemistry I Laboratory, advanced separation technique theory is studied. CHM 229 Organic Chemistry II and CHM387 Quantitative Analysis with their associated labs expose students to additional information about both techniques.

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1.5.4	electrochemical analysis	B	Potentiometric titration in CMH111 lab. Through lecture and class discussion in CHM 228 Organic Chemistry I Laboratory, advanced separation technique theory is studied.	CHM 229 Organic Chemistry II discusses the technique. Potentiometric titration in CMH111 lab.
1.5.5	spectroscopic analysis	B	CHM110 and CHM111, General Chemistry Labs I and II utilize UV-visible spectrometers as well as X-ray fluorescence spectrometry.	CHM110 and CHM111, General Chemistry Labs I and II utilize UV-visible spectrometers as well as X-ray fluorescence spectrometry.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
2.0	Apply mathematics, including calculus and statistics, to investigations in chemistry and the analysis of data;	Use of quantitative mathematical analysis occurs in CHM 470 (exams, homework assignments) with topics of enzyme kinetics and buffers. Education courses continue the candidates' development of their ability to analyze data to inform their teaching practices. In EDU 475 Curriculum and Methods of Teaching in Secondary Schools: Science, their projects and papers must include demonstration of their use of data for teaching and assessing their secondary students.	Use of quantitative mathematical analysis occurs in CHM 470, CHM 471 (exams, homework assignments) with topics of enzyme kinetics and buffers. Education courses continue the candidates' development of their ability to analyze data to inform their teaching practices. In EDU 475 Curriculum and Methods of Teaching in Secondary Schools: Science, their projects and papers must include demonstration of their use of data for teaching and assessing their secondary students.
3.0	relate the concepts of chemistry to contemporary, historical, technological, and societal issues; in particular, relate concepts of chemistry to current controversies, such as those around energy uses and medical research, as well as other issues;	General chemistry, CHM107 and CHM108 discuss. The relationship of material to societal issues, especially in regard to health related issues, is learned through lectures and discussions in CHM 470. The students must also work in groups of two on a project to investigate the structure function relationship in protein structure. They are to explain where a point mutation or loss/gain of a small region of a protein gives rise to a clinical disorder. The project involves research of refereed journal articles and web data base or protein structure databases and their use in both the written and Power Point assisted class presentation. In addition to demonstrating their knowledge through those activities, the students also write three examinations and a final examination on societal concerns such as global warming, pollution, and energy feedstock depletion. As the discovery of new chemistry concepts reaches the public (e.g. pharmaceutical) and implementation (e.g. bio-chemical	General chemistry, CHM107 and CHM108 discuss. The relationship of material to societal issues, especially in regard to health related issues, is learned through lectures and discussions in CHM 470. The students must also work in groups of two on a project to investigate the structure function relationship in protein structure. They are to explain where a point mutation or loss/gain of a small region of a protein gives rise to a clinical disorder. The project involves research of refereed journal articles and web data base or protein structure databases and their use in both the written and Power Point assisted class presentation. In addition to demonstrating their knowledge through those activities, the students also write three examinations and a final examination. As the discovery of new chemistry concepts reaches the public (e.g. pharmaceutical) and implementation (e.g. bio-chemical attacks) occurs, they impact society, the schools, and what is taught to elementary and secondary students. Through the interactive lecture and discussion

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No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
3.0 (cont.)		attacks) occurs, they impact society, the schools, and what is taught to elementary and secondary students. Through the interactive lecture and discussion format of EDU 440 School and Society and EDU 514 Society and Education, study of the impact of such issues on school finance and curriculum will facilitate the candidates' understanding of the connection of chemical concepts to current and other issues.	format of EDU 440 School and Society and EDU 514 Society and Education, study of the impact of such issues on school finance and curriculum will facilitate the candidates' understanding of the connection of chemical concepts to current and other issues.
4.0	locate resources, design and conduct inquiry-based open-ended investigations in chemistry, interpret findings, communicate results, and make judgments based on evidence;	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. In order for Teacher Education candidates to teach these skills to their secondary students, they must attain the research skills unique to chemistry in the Chemistry classes. The Education courses require students to use basic research skills to investigate educational issues and to create curriculum, units, and lessons for their potential secondary students (EDU 401/402, 469, 475) and to demonstrate their ability to teach the skills during their Student Teaching semester. 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.	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. In order for Teacher Education candidates to teach these skills to their secondary students, they must attain the research skills unique to chemistry in the Chemistry classes. The Education courses require students to use basic research skills to investigate educational issues and to create curriculum, units, and lessons for their potential secondary students (EDU 401/402, 469, 475) and to demonstrate their ability to teach the skills during their Student Teaching semester. 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.

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No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
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;	Covered in all laboratory courses. The choices in Chemistry and Society (CHM 103 Chemistry and Society, CHM 429 Industrial Chemistry Societal Issues, and CHM 474 Biochemical Social Issues) are designed to facilitate the students' understanding of the role of science in human affairs. The skills learned in the Chemistry 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, and papers.	Covered in all laboratory courses. The choices in Chemistry and Society (CHM 103 Chemistry and Society, CHM 429 Industrial Chemistry Societal Issues, and CHM 474 Biochemical Social Issues) are designed to facilitate the students' understanding of the role of science in human affairs. The skills learned in the Chemistry 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, and papers.
6.0	understand and promote the maintenance of a safe science classroom as identified by the Council of State Science Supervisors, including the appropriate use and storage of scientific equipment, and the safe storage, use, and disposal of chemicals;	Discussed and practiced in all laboratory classes. Teacher Education candidates will see the qualities of a safe classroom during the field study/case study project in EDU 401/402 when they spend time in a 9-12 grade classroom of their major and/or minor. EDU 469, which includes study of classroom leadership/management, will enhance the candidates' ability to provide safe classrooms. The unique requirements for safety in a Chemistry classroom and laboratory are studied and demonstrated in the science methods course, EDU 475. During their Student Teaching experience, candidates are expected to follow and enforce the policies of the school to which they are assigned.	Discussed and practiced in all laboratory classes. Teacher Education candidates will see the qualities of a safe classroom during the field study/case study project in EDU 401/402 when they spend time in a 9-12 grade classroom of their major and/or minor. EDU 469, which includes study of classroom leadership/management, will enhance the candidates' ability to provide safe classrooms. The unique requirements for safety in a Chemistry classroom and laboratory are studied and demonstrated in the science methods course, EDU 475. During their Student Teaching experience, candidates are expected to follow and enforce the policies of the school to which they are assigned.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
7.0	demonstrate competence in the practice of teaching as defined within the Entry-Level Standards for Michigan Teachers;	Classes above the 100-level routinely involve student presentations to peers and faculty members. The Education program is built around the *Entry-Level Standards for Michigan Teachers* (*ELSMT*). Assignments are required to reference the *ELSMT*. The portfolio that UDM students prepare throughout their Education program is designed to demonstrate their acquisition of the Entry-Level standards. For example in EDU 469, students create a variety of "Portfolio Quality Assignments" that must reference the MDE web sites and demonstrate use of the materials and standards offered. In EDU 459 and 600 (Education Technology), the objectives are set using ELSMT standards. In addition to related lectures and discussions, the students are expected to use and reference these standards in their assignments, written and class presentations. In EDU 475 Science Methods, the students begin their personal collection of folders for their "teaching management kit." Students are required to use the MDE sites as basis for their field experience/observation write ups and lesson/unit plans that are part of the course. Lectures and classroom discussions help students understand the ELSMT standards and how to incorporate them into their assignments.	Classes above the 100-level routinely involve student presentations to peers and faculty members. The Education program is built around the *Entry-Level Standards for Michigan Teachers* (*ELSMT*). Assignments are required to reference the *ELSMT*. The portfolio that UDM students prepare throughout their Education program is designed to demonstrate their acquisition of the Entry-Level standards. For example in EDU 469, students create a variety of "Portfolio Quality Assignments" that must reference the MDE web sites and demonstrate use of the materials and standards offered. In EDU 459 and 600 (Education Technology), the objectives are set using ELSMT standards. In addition to related lectures and discussions, the students are expected to use and reference these standards in their assignments, written and class presentations. In EDU 475 Science Methods, the students begin their personal collection of folders for their "teaching management kit." Students are required to use the MDE sites as basis for their field experience/observation write ups and lesson/unit plans that are part of the course. Lectures and classroom discussions help students understand the ELSMT standards and how to incorporate them into their assignments.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
8.0	create and maintain an educational environment in which conceptual understanding will occur for all science students;	Small group learning is a component of most classes, including 100-level classes. Once again, students learn how to create and maintain a positive classroom environment for conceptual understanding of Chemistry principles and skills in EDU 401/402 and in the methods courses: EDU 469 and 475. In the education technology courses (EDU 459 and 600), project based learning based on research with emphasis on constructivism and scaffolding is required; thereby providing the candidates with strategies to create and maintain a positive learning environment for all students. SED 460 Education and Mainstreaming of Exceptional Persons is required for all Education candidates. 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. Objective 9 identifies that candidates will demonstrate the ability to present concepts and manage special education students at different levels and within the regular classroom. In their student teaching assignments (EDU 490, 474, 484), part of the candidates' assessments is their ability to provide such a learning environment for their secondary students.	Small group learning is a component of most classes, including 100-level classes. Once again, students learn how to create and maintain a positive classroom environment for conceptual understanding of Chemistry principles and skills in EDU 401/402 and in the methods courses: EDU 469 and 475. In the education technology courses (EDU 459 and 600), project based learning based on research with emphasis on constructivism and scaffolding is required; thereby providing the candidates with strategies to create and maintain a positive learning environment for all students. SED 460 Education and Mainstreaming of Exceptional Persons is required for all Education candidates. 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. Objective 9 identifies that candidates will demonstrate the ability to present concepts and manage special education students at different levels and within the regular classroom. In their student teaching assignments (EDU 490, 474, 484), part of the candidates' assessments is their ability to provide such a learning environment for their secondary students.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
9.0	demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific process and assessing student learning through multiple processes;	The mixture of lecture, lab, small group learning, problem solving, library research, and student presentations in the Chemistry courses demonstrates these principles. The mission of the UDM Teacher Education Program emphasizes the conceptualization of the role of the teacher as having three dimensions: developing teachers who behave professionally as scholars, inquirers, and moral agents. The Education courses seek to prepare students who are skilled in decision-making and in ethical, critical, and reflective thinking (inquirers) and who use the research-knowledge base for teaching, integrated with the liberal arts and sciences disciplines (scholars). As explained in Rule A and Standards 4.0 and 6.0 of this matrix plus in Part C Varied Instructional Approaches of Section 2, the major assignment of EDU 401/402 is an investigative experience requiring the application of scientific processes. They conduct a field/case study that relies on observation, analysis, and written explanations and conclusions. While the research required in courses such as EDU 420 or 525 (Philosophy and Policy Studies) and in EDU or 514 (Schools/Education and Society) does not result in physical science findings that research in Chemistry demands, similar processes and methods are adhered to as candidates study and report their findings about aspects of education practice. In the methods courses (EDU 469, 475), candidates learn how to apply the appropriate	The mixture of lecture, lab, small group learning, problem solving, library research, and student presentations in the Chemistry courses demonstrates these principles. The mission of the UDM Teacher Education Program emphasizes the conceptualization of the role of the teacher as having three dimensions: developing teachers who behave professionally as scholars, inquirers, and moral agents. The Education courses seek to prepare students who are skilled in decision-making and in ethical, critical, and reflective thinking (inquirers) and who use the research-knowledge base for teaching, integrated with the liberal arts and sciences disciplines (scholars). As explained in Rule A and Standards 4.0 and 6.0 of this matrix plus in Part C Varied Instructional Approaches of Section 2, the major assignment of EDU 401/402 is an investigative experience requiring the application of scientific processes. They conduct a field/case study that relies on observation, analysis, and written explanations and conclusions. While the research required in courses such as EDU 420 or 525 (Philosophy and Policy Studies) and in EDU or 514 (Schools/Education and Society) does not result in physical science findings that research in Chemistry demands, similar processes and methods are adhered to as candidates study and report their findings about aspects of education practice. In the methods courses (EDU 469, 475), candidates learn how to apply the appropriate investigative practices to assessing their students'

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
9.0 (cont.)	demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific process and assessing student learning through multiple processes;	investigative practices to assessing their students' learning and reporting their findings to parents and school officials. In EDU 475, students demonstrate to the class one lesson which includes assessment. The class discusses the entire lesson and how student performance is evaluated. Multiple intelligence and processes articles are distributed and discussed in class. One of their "teaching/management kit" folders contains materials about how they will assess students. Handouts are given and explained on various types of assessment, which they are expected to apply in appropriate assignments. Examples of how to write rubrics are demonstrated and practiced, especially in terms of the MEAP tests. Students also learn how to write mid-term and final examinations. Their field experience for EDU 475 includes the candidates teaching two lessons which demonstrate the application of scientific processes. The education technology courses (EDU 459 and 460) place emphasis on authentic assessment using various processes. During the candidates' student teaching experience (EDU 490, 474, or 484), they are required to apply these principles and processes to their involvement in assessing secondary students' progress according to the high school's policies.	learning and reporting their findings to parents and school officials. In EDU 475, students demonstrate to the class one lesson which includes assessment. The class discusses the entire lesson and how student performance is evaluated. Multiple intelligence and processes articles are distributed and discussed in class. One of their "teaching/management kit" folders contains materials about how they will assess students. Handouts are given and explained on various types of assessment, which they are expected to apply in appropriate assignments. Examples of how to write rubrics are demonstrated and practiced, especially in terms of the MEAP tests. Students also learn how to write mid-term and final examinations. Their field experience for EDU 475 includes the candidates teaching two lessons which demonstrate the application of scientific processes. The education technology courses (EDU 459 and 460) place emphasis on authentic assessment using various processes. During the candidates' student teaching experience (EDU 490, 474, or 484), they are required to apply these principles and processes to their involvement in assessing secondary students' progress according to the high school's policies.

		Narrative Explaining how Required Courses and/or Experiences Fulfill the Standards for Program	
No.	**Standard/Guideline**	**Secondary Minor**	**Secondary Major**
	The preparation of high school chemistry teachers will enable teachers to:		
10.0	develop an understanding and appreciation for the nature of scientific inquiry; and	Begins with CHM110 lab, in which students must design one experimental procedure, and continues through all other lab classes. The assignments, projects, presentations, discussions, and other instructional practices in the Education courses continue the candidates' involvement in scientific inquiry. They graduate understanding that decision-making throughout the field of education must be data driven.	Begins with CHM110 lab, in which students must design one experimental procedure, and continues through all other lab classes. The assignments, projects, presentations, discussions, and other instructional practices in the Education courses continue the candidates' involvement in scientific inquiry. They graduate understanding that decision-making throughout the field of education must be data driven.
11.0	understand chemistry as the study of the composition, structure, properties, reactions of matter, and the dynamic interrelations of matter.	All CHM courses. Starts with CHM107 and discussion of make up of matter, and continues through to CHM474 Special Topics in Biochemistry when advanced structures are discussed. The Education instructors expect the secondary education candidates to understand d this concept when they enter the Education program. The candidates learn how to help secondary students develop their understanding in the methods courses: EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools I and EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. As explained in earlier standards, the assignments require students to develop lesson and unit plans based on the MDE standards for teachers and secondary students. Once again, their Student Teaching experience requires them to demonstrate their ability to deliver instruction to secondary students that will facilitate their understanding of this basic chemistry concept.	All CHM courses. Starts with CHM107 and discussion of make up of matter, and continues through to CHM474 Special Topics in Biochemistry when advanced structures are discussed. The Education instructors expect the secondary education candidates to understand this concept when they enter the Education program. The candidates learn how to help secondary students develop their understanding in the methods courses: EDU 469 Curriculum and Methods of Teaching in Middle and Secondary Schools I and EDU 475 Curriculum and Methods of Teaching in Middle and Secondary Schools II: Science. As explained in earlier standards, the assignments require students to develop lesson and unit plans based on the MDE standards for teachers and secondary students. Once again, their Student Teaching experience requires them to demonstrate their ability to deliver instruction to secondary students that will facilitate their understanding of this basic chemistry concept.