JOHN ENGLER

STATE OF MICHIGAN
DEPARTMENT OF EDUCATION
LANSING

MICHIGAN Department of Education
THOMAS D. WATKINS, JR.
SUPERINTENDENT OF
PUBLIC INSTRUCTION

July 24, 2002

MEMORANDUM

TO: State Board of Education

FROM: Thomas D. Watkins, Jr., Chairman

SUBJECT: Approval of Standards for the Preparation of Chemistry Teachers

In pursuit of its goal to improve teacher quality, the State Board of Education receives proposals for the adoption and revision of program standards for teacher preparation. Proposed standards are developed to reflect and support Michigan's K-12 Curriculum Framework and Benchmarks, as well as standards adopted by national professional/specialty area organizations.

Over the last several years, a referent group reflecting the interests of public and independent teacher preparation institutions and K-12 teachers worked on the development of standards for the preparation of chemistry teachers. The committee began its work by reviewing the Michigan Curriculum Framework for science and standards for the preparation of teachers as developed by the National Science Teachers Association to ensure alignment with both documents.

Ongoing feedback from K-12 schools and teacher preparation institutions from 2000 through 2002 was utilized in making significant revisions to an earlier proposal. A draft was forwarded to selected groups/organizations, all Michigan teacher preparation institutions, and a random sample of intermediate and local school districts for review and comment in September 2000. As presented in Attachment 1, the standards reflect the feedback received. Additional information regarding the standards development and review process is provided in Attachment 2.

The proposal was reviewed by the Board-appointed Professional Standards Commission for Teachers and is recommended for adoption by the State Board of Education.

It is recommended that the State Board of Education approve the standards for the preparation of chemistry teachers, as discussed in the Superintendent's memorandum dated July 24, 2002.

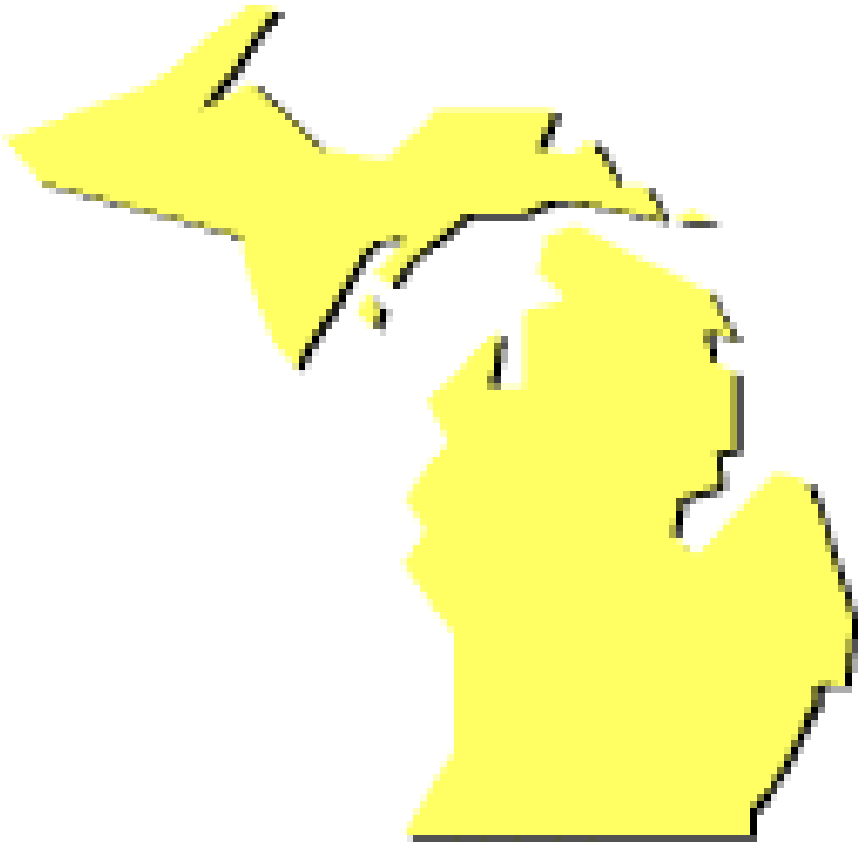
Proposal to the Michigan State Board of Education For the Preparation of Teachers

Chemistry (DC)

Submitted by the
Office of Professional Preparation Services
July 24, 2002

Standards for the Preparation of Teachers

Chemistry (DC)



Adopted by the Michigan State Board of Education
<date>

Standards for the Preparation of Teachers of Chemistry
(DC Endorsement)

Preface

Development of the Proposal

Over the last several years, a referent group of professional educators developed a proposal to adopt standards for the preparation of chemistry teachers. These standards align with standards developed by the National Science Teachers Association for teacher preparation standards and the Michigan Curriculum Framework for science education. Teachers who receive the endorsement in chemistry would be prepared to teach any chemistry course at their certificate level.

To provide information and gather feedback on the proposal, a copy was also forwarded to selected groups/organizations, all Michigan teacher preparation institutions, and a random sample of intermediate and local school districts for review and comment. As presented in this document, the standards reflect the feedback received.

State Board adoption of these standards typically leads to the creation of a new certification test for teachers prepared to teach this content area. Test development for a new Michigan Test for Teacher Certification in chemistry will be scheduled according to the recommendation of the Standing Technical Advisory Council.

Approval of Programs

Teacher preparation institutions that wish to continue to offer programs to prepare chemistry teachers are required to submit an application for program approval that demonstrates how the new standards are met throughout the proposed curriculum. The programs must be re-approved to show compliance with the new standards. Following initial approval, the teacher preparation programs will be reviewed every five years through the Periodic Review/Program Evaluation process.

Content Guidelines/Standards Matrix

College/University _____ **Code** DC

Source of Guidelines/Standards Michigan State Board of Education, 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.

	Guideline/Standard	Courses and/or Experiences that Fulfill the Guideline	
		Secondary Minor	Secondary Major
	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		
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.		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline	
			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		
1.1.2	stoichiometry	C		
1.1.3	thermodynamics and thermochemistry	C		
1.1.4	gas laws	C		
1.1.5	states of matter	C		
1.1.6	equilibria	C		
1.1.7	acid-base	C		
1.1.8	electrochemistry	C		
1.1.9	nomenclature	B		
1.1.10	qualitative analysis	C		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline	
			Secondary Minor	Secondary Major
1.2	Organic Chemistry, including			
1.2.1	functional groups	C		
1.2.2	nomenclature	C		
1.2.3	aliphatic and alicyclic reactions	A		
1.2.4	stereochemistry	A		
1.2.5	structure and reactivity of major functional groups	B		
1.2.6	aromatic compounds	B		
1.2.7	spectroscopy	B		
1.2.8	heterocyclic compounds	A		
1.2.9	polymers	A		
1.2.10	bromolecules	A		
1.3	Physical Chemistry, including			
1.3.1	chemical thermodynamics	B		
1.3.2	thermochemistry	B		
1.3.3	electrolyte solutions	B		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline	
			Secondary Minor	Secondary Major
1.3.4	measurements of physical properties of solids, liquids, and gases	C		
1.3.5	phase equilibria	C		
1.3.6	molecular spectra	B		
1.3.7	spectroscopy	B		
1.3.8	calorimetry	C		
1.3.9	quantum mechanics	C		
1.4	Biochemistry, including			
1.4.1	biomolecules – proteins, lipids, carbohydrates, nucleic acids – their structure and function	C		
1.4.2	aqueous pollutions	B		
1.4.3	buffers	B		
1.4.4	enzyme kinetics	B		
1.4.5	thermodynamics	B		
1.4.6	electron transport	B		
1.4.7	oxidative phosphorylation	B		
1.4.8	metabolism	B		

No.	Guideline/Standard	Level of Proficiency	Courses and/or Experiences that Fulfill the Guideline	
			Secondary Minor	Secondary Major
1.4.9	biosynthesis/biodegradation pathway	B		
1.5	Analytical Chemistry, including			
1.5.1	ionic equilibria	C		
1.5.2	electrochemistry	B		
1.5.3	advanced separation technique – GLC and HPLC	B		
1.5.4	electrochemical analysis	B		
1.5.5	spectroscopic analysis	B		

No.	Guideline/Standard	Courses and/or Experiences that Fulfill the 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;		
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;		
4.0	locate resources, design and conduct inquiry-based open-ended investigations in chemistry, interpret findings, communicate results, and make judgments based on evidence;		
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;		
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;		
7.0	demonstrate competence in the practice of teaching as defined within the Entry-Level Standards for Michigan Teachers;		
8.0	create and maintain an educational environment in which conceptual understanding will occur for all science students;		

No.	Guideline/Standard	Courses and/or Experiences that Fulfill the Guideline	
		Secondary Minor	Secondary Major
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;		
10.0	develop an understanding and appreciation for the nature of scientific inquiry; and		
11.0	understand chemistry as the study of the composition, structure, properties, reactions of matter, and the dynamic interrelations of matter.		

Attachment 2

List for Distribution of Draft Standards

Chemistry (DC)

Teacher Preparation Standards Development Committee
for
Biology, Chemistry, Physics, Physical Science, Earth/Space Science,
Integrated Science – Elementary, and Integrated Science – Secondary

Maurice Barnes	Grand Rapids Central High School
Frank Ciloski	Michigan Department of Education
Claudia Douglass	Central Michigan University
Ray Francis	Central Michigan University
David Frank	Ferris State University
Dan Genter	Dansville High School
Jim Hewitt	Saginaw Valley State University
Stanley Hirachi	Central Michigan University
Joseph Krajcik	University of Michigan
David Klingbiel	Dansville High School
Mozell Lang	Michigan Department of Education
Peggy Liggett	Eastern Michigan University
Catherine Smith	Michigan Department of Education
Deborah Smith	Michigan State University
Steven Stegink	Grand Rapids Public Schools
Jane Teska	Southfield Public Schools
Denny Travis	Oakland University
Sue Wittick	Michigan Department of Education

List for Distribution of Draft Standards
Chemistry (DC))

Educational Organizations

Association of Independent Colleges & Universities of Michigan

Directors and Representatives of Teacher Education Programs

* Michigan Association of Colleges for Teacher Education

Michigan Association of Nonpublic Schools

Michigan Association of School Administrators

Michigan Association of School Boards

Michigan Association of School Personnel Administrators

Michigan Association of Secondary School Principals

Michigan Association of Supervision & Curriculum Development

Michigan Association of Teacher Educators

Michigan Congress of Parents, Teachers, and Students

Michigan Deans' Council

* Michigan Earth Science Teachers Association

Michigan Education Association

Michigan Elementary & Middle School Principals Association

Michigan Federation of Teachers & School Related Personnel

Michigan Science Teachers Association

Middle Cities Education Association

Professional Standards Commission for Teachers

* Indicates submission of a response

Teacher Preparation Institutions

Chemistry (DC)

* Adrian College
Albion College
Alma College
* Andrews University
Aquinas College
Calvin College
Central Michigan University
Concordia University
Cornerstone University
* Eastern Michigan University
Ferris State University
* Grand Valley State University
Hillsdale College
Hope College
* Kalamazoo College
Lake Superior State University
* Madonna University
* Marygrove College
* Michigan State University
Michigan Technological University
Northern Michigan University
* Oakland University
Olivet College
Saginaw Valley State University
Siena Heights University
* Spring Arbor University
* University of Michigan – Dearborn
University of Michigan – Flint
University of Detroit Mercy
* University of Michigan
* Wayne State University
* Western Michigan University

* Indicates submission of a response

Local School Districts
Chemistry (DC)

Armada Area Schools
Bangor Public Schools
Van Buren Public Schools
Boyne Falls Public Schools
Atherton Community Schools
* Carsonville-Port Sanilac Schools
Clare Public Schools
Constantine Schools
Decatur Public Schools
East China School District
* Engadine Consolidated Schools
Flat Rock Community Schools
Fruitport Community Schools
Grand Marais-Burt Township Schools
Hamilton Community Schools
Hastings School District
* Hanover-Horton Schools
Iron Mountain-North Dickinson County Schools
Kalkaska Public Schools
Lansing School District
Lakeview Community Schools
Mackinac Island Public Schools
Marshall-Mar Lee School District
Middleton-Fulton Schools
Mt. Morris Consolidated Schools
New Haven Community Schools
Okemos Public Schools
Paradise-Whitefish Township Schools
Pinconning Area Schools
Reading Community Schools
Rogers City Area Schools
Scottville-Mason County Central Schools

*Indicates submission of a response

Intermediate School Districts (ISD)
Chemistry (DC)

Allegan County
Charlevoix-Emmet
Dickinson-Iron
Huron
Ionia County
Lapeer
Mason-Lake
Newaygo
St. Joseph
Washtenaw

*Indicates submission of a response

NOTE: Additional responses were received anonymously.