

Standards for the Preparation of Teachers

Chemistry (DC)



Adopted by the Michigan State Board of Education
August 8, 2002

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.

Proficiency Levels

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)

These proficiency levels for each standard are indicated at the end of each standard in parenthesis.

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 Biology teachers have the content knowledge and the ability to teach this curriculum; and
- B. develops an understanding of the interconnectedness of all science, including the major concepts of chemistry, the earth/space sciences, and physics, and relates this understanding to the teaching of biology and the life sciences.

1.0 The preparation of chemistry teachers will enable them to 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)
- 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. biomolecules (A)

- 1.3. Physical Chemistry, including
 - 1.3.1. chemical thermodynamics (B)
 - 1.3.2. thermochemistry (B)
 - 1.3.3. electrolyte solutions (B)
 - 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 solutions (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)
 - 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)
2. apply mathematics, including calculus and statistics, to investigations in chemistry and the analysis of data;
3. 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. locate resources, design and conduct inquiry-based open-ended investigations in chemistry, interpret findings, communicate results, and make judgments based on evidence;
5. 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. 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. demonstrate competence in the practice of teaching as defined within the Entry-Level Standards for Michigan Teachers;
8. create and maintain an educational environment in which conceptual understanding will occur for all science students;

9. 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. develop an understanding and appreciation for the nature of scientific inquiry; and
11. understand chemistry as the study of the composition, structure, properties, reactions of matter, and the dynamic interrelations of matter.