Standards for the Preparation of Teachers

Physical Science (DP)

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

Standards for the Preparation of Teachers of Physical Science (Secondary)
DP 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 physical science teachers. These standards align with standards developed by the National Science Teachers Association and the Michigan Curriculum Framework for science education. Teachers who receive the endorsement in physical science would be prepared to teach any physical science (chemistry or physics) course at their certificate level.

A teacher candidate choosing to earn a secondary physical science endorsement will be prepared to teach physical science, chemistry, and physics at the secondary level. Candidates may elect to earn a group major of 36 semester credits and a comprehensive group major of 50 credits when earning this endorsement. Candidates who apply for the DP endorsement must pass the Michigan Test for Teacher Certification physical science test.

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 secondary physical science 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 secondary physical science 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.

Levels of Proficiency

A – Awareness

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

B – Basic Understanding

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

C – Comprehensive Understanding

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

A teacher candidate choosing to earn a Secondary Physical Science Endorsement will be prepared to teach physical science, chemistry, and physics at the secondary level. Candidates may elect to earn a group major of 36 semester credits and a group minor of 24 semester credits, or a comprehensive group major of 50 credits when earning this endorsement. Candidates who apply for the DP endorsement must pass the Michigan Test for Teacher Certification physical science test.

DIRECTIONS: List required courses 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.

Submit a narrative that explains how this program:

- uses the Michigan Curriculum Framework K-12 Science Content Standards and Benchmarks as the critical foundation for teacher preparation, ensuring that secondary physical science teachers have the content knowledge and the ability to teach this curriculum; and
- develops student understanding of the interconnectedness of all science, including earth science and biology, and relates this understanding to the teaching of physical science.

The preparation of secondary physical science teachers should:

1.0 understand and develop the major concepts and principles of physics and chemistry which shall include the following topics:

1.1 Major Concepts and Principles of Chemistry

1.1.1 Inorganic Chemistry, including

1.1.1.1 atomic/molecular structure and bonding (C)
1.1.1.2 stoichiometry (C)
1.1.1.3 gas laws (C)
1.1.1.4 states of matter (C)
1.1.1.5 chemical kinetics (C)
1.1.1.6 equilibria (C)

1.1.1.7 acid-bases (C)
1.1.1.8 electrochemistry (C)
1.1.1.9 nomenclature (C)
1.1.1.10 qualitative analysis (C)

1.1.2 Physical Chemistry, including
1.1.2.1 measurements of physical properties of solids, liquids, and gases (C)
1.1.2.2 phase equilibria (C)
1.1.2.3 calorimetry
1.1.2.4 quantum mechanics

1.1.3 Organic Chemistry, including:
1.1.3.1 functional groups (C)
1.1.3.2 nomenclature (C)
1.1.3.3 aliphatic and alicyclic reactions (A)
1.1.3.4 stereochemistry (A)
1.1.3.5 structure and reactivity of major functional groups (B)
1.1.3.6 aromatic compounds (B)
1.1.3.7 spectroscopy (B)
1.1.3.8 polymers (B)
1.1.3.9 biomolecules (B)

1.2 Major Concepts and Principles of Physics, including
1.2.1 mechanics (C)
1.2.2 electricity (C)
1.2.3 magnetism (C)
1.2.4 thermodynamics (C)
1.2.5 waves and vibrations (C)
1.2.6 optics (C)
1.2.7 atomic and nuclear physics (B)
1.2.8 radioactivity (B)
1.2.9 relativity (A)
1.2.10 quantum mechanics (A)

The preparation of physical science teachers will enable them to:

2.0 apply mathematics, including statistics and precalculus, to investigations in physical science and the analysis of data;

3.0 relate the concepts of physical science to contemporary, historical, technological, and societal issues; in particular, relate concepts of physical science to current controversies, such as the use of energy, medical research, and other issues;

4.0 locate resources, design and conduct inquiry-based open-ended investigations in physical science, 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 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;

9.0 demonstrate competence in the practice of teaching through investigative experiences and by demonstrating the application of the scientific processes and in assessing student learning through multiple processes; and

10.0 develop an understanding and appreciation for the nature of scientific inquiry.