

Endorsement Competencies for Chemistry 5-12

2007 Standards for Chemistry
1.0 Common Core – Content:
1.1 The chemistry teacher knows and understands scientific concepts and principles that are needed to advance student learning as defined by state and national standards developed by the science education community, including major unifying themes. Content includes the big ideas of science and the mathematics underlying them. This includes basic principles of biology, earth and space science, physics and mathematics as they relate to chemistry.
1.1.1 Mathematics – Applications of mathematics in chemistry research, including: <ul style="list-style-type: none">• Algebra• Probability and statistics• Calculus
1.1.2 Knowing – Science is a way of asking and answering questions about the physical universe. <ul style="list-style-type: none">• Scientific Investigation• Other ways of knowing science
1.1.3 Structure of Atoms <ul style="list-style-type: none">• Atomic theory• Organization of the Atom• Nuclear Forces, fission, fusion• Radioactivity• Electron Configuration
1.1.4 Structure and Properties of Matters <ul style="list-style-type: none">• Physical and Chemical Properties of Matter• Chemical bonds• Periodic Table• Elements, Compounds and Mixtures• Intermolecular and Intramolecular Forces• States of Matter• Characteristics of Organic Molecules
1.1.5 Chemical Reactions <ul style="list-style-type: none">• Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.• Conservation of Matter• Endothermic and Exothermic Reactions• Oxidation-Reduction• Acid-Base• Free Radicals• Rates of Reaction and Equilibrium• Catalysis
1.1.6 Conservation of Energy <ul style="list-style-type: none">• Total energy of universe is constant

<ul style="list-style-type: none"> • Laws of thermodynamics • Heat and Temperature • Specific Heat Capacity • Chemical Potential • Energy, forms, transfer, and transformation
1.1.7 Interactions of Energy and Matter <ul style="list-style-type: none"> • Nature of Waves • Electromagnetic waves • Interactions of Matter and light
1.1.8 Supporting Knowledge: Biology <ul style="list-style-type: none"> • Biomolecules
1.1.9 Supporting Knowledge: Physics <ul style="list-style-type: none"> • Electricity and Magnetism • The four fundamental forces • Subatomic particles
1.2 Inquiry – The chemistry teacher knows and understands scientific inquiry: <ul style="list-style-type: none"> • Understand how to generate and evaluate questions that can be answered through scientific investigations. • Understand how to plan and conduct systematic and complex scientific investigations. • Synthesize a revised scientific explanation using evidence, data, and inferential logic. • Analyze how physical, conceptual, and mathematical models represent and are used to investigate objects, events, systems, and processes. • Apply understanding of how to report complex scientific investigations and explanations of objects, events, systems, and processes, and how to evaluate scientific reports. • Analyze why curiosity, honesty, cooperation, openness, and skepticism are important to scientific explanations and investigations. • Analyze scientific theories for logic, consistency, historical and current evidence, limitations, and capacity to be investigated and modified. • Evaluate inconsistent or unexpected results from scientific investigations using scientific explanations. • Analyze scientific investigations for validity of method and reliability of results. • Understand how scientific knowledge evolves.
1.3 Nature and Context of Science - The chemistry teacher knows the values, beliefs and assumptions inherent to the creation of scientific knowledge within the scientific community, and contrasts science to other ways of knowing. <ul style="list-style-type: none"> • Analyze local, regional, national, or global problems or challenges in which scientific design can be or has been used to design a solution. • Evaluate the scientific design process used to develop and implement solutions to problems or challenges. • Evaluate consequences, constraints, and applications of solutions to a problem or challenge. • Analyze how scientific knowledge and technological advances discovered and

<p>developed by individuals and communities in all cultures of the world contribute to changes in societies.</p> <ul style="list-style-type: none"> • Analyze how the scientific enterprise and technological advances influence and are influenced by human activity. • Analyze the scientific, mathematical, and technological knowledge, training, and experience needed for occupational/career areas of interest. • Analyze the effects human activities have on Earth's capacity to sustain biological diversity.
<p>1.4 The teacher is able to:</p> <ul style="list-style-type: none"> • Use processes and conventions of science as a professional activity. • Use standards defining acceptable evidence and scientific explanation. • Explain the nature of scientific inquiry including intellectual honesty, limitations of science and technology, dealing with inconsistencies, evaluating methods of investigation, and evolution of scientific ideas. • Explain that science and technology are human endeavors, interrelated to each other, to society, and to the workplace (e.g., all peoples contribute to science and technology, science and technology are interrelated, many careers and occupations use science, mathematics, and technology).
<p>1.5 The teachers know the relationship between chemistry and the daily lives and interests of students and to a larger framework of human endeavor and understanding. The context of science refers to:</p> <ul style="list-style-type: none"> • Knowing how science and technology interact with society. • Knowing how values are used in scientific, technological, personal, social, and cultural contexts. • Knowing the relevance and importance of life science to the personal lives of students.
<p>1.6 Chemistry teachers relate science to the daily lives and interests of students and to a larger framework of human endeavor and understanding. The context of science refers to:</p> <ul style="list-style-type: none"> • Enabling students to recognize relationships between science and technology and society. • Enabling students to recognize the use of values in scientific, technological, personal, social, and cultural contexts. • Being able to demonstrate the relevance and importance of science to the personal lives of students.
<p>2.0 Common Core – Instructional Methodology:</p>
<p>2.1 Skills of Teaching: Chemistry teachers know the equipment, materials, and preparation required in the laboratory, including:</p> <ul style="list-style-type: none"> • Design of controlled investigations • Data analysis and presentation • Preparation of laboratory reports • Operation of equipment • Preparation of materials • Lab safety (including storage and disposal of hazardous waste)
<p>2.1.1 Chemistry teachers, incorporating instructional materials, create a community of</p>

diverse student learners who can construct meaning from science and possess a disposition for further inquiry and learning. Skills of Teaching refers to:

- Able to use science teaching actions, strategies, and methodologies.
- Able to establish interactions with students, including questioning techniques, that promote learning and achievement.
- Able to effectively organize classroom, laboratory, and field experiences in different student groupings.
- Able to use advanced technology to extend and enhance learning.
- Able to use prior conceptions and student interests to promote new learning.
- Able to design investigations.
- Able to analyze and present data.
- Able to prepare laboratory reports.
- Able to operate chemistry laboratory equipment.
- Able to prepare materials used in the chemistry laboratory.
- Able to establish and enforce lab safety (including storage and disposal of hazardous waste) in the chemistry laboratory.
- Monitor students' understanding of content through a variety of assessment strategies, provide feedback to students to assist learning, adjust instruction and encourage students to learn to work together to solve problems.
- Being able to use advanced technology to extend and enhance learning.
- Design, conduct, and evaluate laboratory activities that target the development of science concepts, using techniques, equipment, and facilities that meet current technological standards including computer applications to science teaching and hands-on laboratory experiences, equipment, and laboratory notebook.
- Being able to use prior conceptions and student interests to promote new learning.
- Integrate reading, writing, communication, mathematics, social studies, and health/fitness into the teaching of chemistry.

2.2 Curriculum – Chemistry teachers know the chemistry curriculum.

- Understand the application of student learning goals including the EARLs and GLEs to design lessons that target state standards (i.e., read with comprehension, write with skill, and communicate effectively with responsibility in a variety of ways and settings, know and apply the core concepts).

2.2.1 The chemistry teacher develops and applies a coherent, focused chemistry curriculum that is consistent with state and national standards for chemistry education and appropriate for addressing the need, abilities, and interests of students. Curriculum refers to:

- Able to develop and apply an extended framework of goals, plans, materials, and resources for instruction.
- Able to develop and apply science principles, both in and out of school.
- Able to plan instruction which promotes problem analysis, critical thinking, creativity, leadership development and decision-making based upon subject matter, organization and integration of content and the relationship of content to education, career and life goals; student learning and motivation, with emphasis on individual differences and diversity; the community and community resources; and current education standards and practices.

<ul style="list-style-type: none"> • Select, analyze, modify and incorporate instructional materials to meet the learning needs and reading level of diverse learners including curriculum resources and technology; inquiry based laboratory experiences; and information from the internet, professional organizations, and business and industry.
<p>2.3 Social Context – Chemistry teachers know the relation between science and the community and know the human and institutional resources in the community. The social context of science teaching refers to:</p> <ul style="list-style-type: none"> • Knowing examples of social and community support networks within which occur life science teaching and learning. • Knowing the relationship of science teaching and learning to the needs and values of various communities.
<p>2.3.1 Chemistry teachers can relate science to the community and to use human and institutional resources in the community to advance the education of their students in chemistry. The social context of science teaching refers to:</p> <ul style="list-style-type: none"> • Being able to develop the social and community support network within which science teaching and learning occur. • Being able to relate science teaching and learning to the needs and values of the community. • Being able to involve people and institutions from the community in the teaching of science.
<p>2.4 Assessment - The chemistry teacher knows a variety of contemporary assessment strategies to evaluate the intellectual, social, and personal development of the learner in all aspects of chemistry. Assessment refers to:</p> <ul style="list-style-type: none"> • Knowing the measurement and evaluation of student learning in a variety of dimensions including state assessments.
<p>2.4.1 The chemistry teacher uses a variety of contemporary assessment strategies to evaluate the intellectual, social, and personal development of the learner in all aspects of science. Assessment refers to:</p> <ul style="list-style-type: none"> • Identifying outcomes to be measured. • Being able to align learning targets, instructions, and outcomes. • Being able to measure and evaluate student learning in a variety of dimensions. • Being able to use outcome data to guide and change instruction. • Monitoring and assessing students’ understanding of content through a variety of means, providing feedback to students to assist learning and adjusting instructional strategies.
<p>2.5 Environment for Learning – Chemistry teachers know safe and supportive learning environments reflecting high expectations for the success of all students. Learning environments refers to:</p> <ul style="list-style-type: none"> • Know examples of changes that can make physical spaces more effective for learning science. • Know typical examples of psychological and social environments of the student engaged in learning science. • Know safety in all areas related to science instruction.
<p>2.5.1 Chemistry teachers design and manage the instructional environment:</p> <ul style="list-style-type: none"> • Able to design/manage physical spaces to enhance learning of science.

- Able to create a climate that promotes fairness.
- Able to establish and maintain rapport with students.
- Able to communicate clear, challenging expectations to each student.
- Able to establish and maintain consistent standards of classroom behavior.
- Able to use instructional time effectively.
- Able to create a safe environment conducive to learning.

3.0 Common Core – Professional Practice:

3.1 Chemistry teachers have a knowledge base that prepares them for professional practice. Professional practice refers to:

- Knowledge of science and educational professional organizations.
- Knowledge of standards of ethical behavior consistent with the best interests of students and the community.

3.2 Chemistry teachers participate in the professional community, improving practice through their personal actions, education, and development. Professional practice refers to teachers being able to:

- Participate in the activities of the professional community to include colleagues, organizations, and other agencies, to improve student learning.
- Demonstrate ethical behavior consistent with the best interests of students and the community, as stated in Washington’s Code of Professional Conduct, and local, state, and federal laws and regulations.
- Reflect on professional practices and continuous efforts to ensure the highest quality of science instruction.
- Willingly work with students and new colleagues as they enter the profession.
- Communicate effectively with parents/guardians, business and industry, and other agencies, and the community at large to support learning by all students.