

Chemistry

I. Knowing the Content

The professional education program provides evidence that Chemistry certification candidates complete a program of Chemistry studies the same as the academic content area courses and required electives of a major in a bachelor's degree. The program shall require the candidates to demonstrate their knowledge of and competence in teaching inquiry based laboratory experiences and the fundamental concepts of chemistry to secondary school students grades 7-12, including:

I.A. Basic principles of mathematics and physics as they relate to chemistry, including:

- relationships between matter and energy,
- Physical parameters, units and dimensional analysis,
- states of matter,
- gas laws and the kinetic-molecular theory

I.B. Applications of chemistry to:

- the life sciences and earth sciences,
- scientific discovery and technological advancement

I.C. Atomic theory including:

- atomic structure and nuclear chemistry,
- electronic configuration and periodicity,
- chemical bonding and molecular structure

I.D. Chemical concepts, including:

- chemical formulas and nomenclature,
- chemical reactions and stoichiometry,
- mixtures, solutions, solubility, and chemical equilibrium

I.E. Inorganic chemistry, including:

- descriptive chemistry of metallic and nonmetallic elements and their industrial importance,
- valence bond and molecular orbital theories,
- group theory and crystal systems,
- chemistry of inorganic complexes

I.F. Organic chemistry, including:

- bonding and structure,
- nomenclature and stereochemistry,
- reactions and mechanisms,
- synthesis and spectroscopy applications related to biology, medicine, industrial chemistry, material sciences, agriculture and emerging areas of technology

I.G. Thermodynamics and kinetics of chemical reactions including:

- laws of thermodynamics,
- chemical equilibrium,
- electrochemistry,
- chemical kinetics

I.H. Extensive laboratory activities including:

- reinforcement or extension of chemical theory,
- experimental design, data collection, analysis and interpretation,
- methods of preparation, use, storage and disposal of reagents conforming to state and federal regulations,
- laboratory safety

I.I. Historical and contemporary issues including:

- ethical implications of science and technology,
- history of chemistry,
- safety of household products, medicine, agriculture, and gardening,
- environment and ecology,
- risk benefit trade-offs

II. Performances

The professional education program shall provide evidence of the candidates participation in sequential and developmental field experiences and student teaching, under the supervision of college personnel and well-trained cooperating teachers who have interpersonal skills and demonstrated competence in teaching chemistry. The program shall provide evidence that the criteria and competencies for exit from the Chemistry certification program are assessed in coursework, field experiences and student teaching and require the candidates to demonstrate their knowledge and competence in fostering student learning through:

II.A. Managing the instructional environment including:

- creating a climate that promotes fairness,
- establishing and maintaining rapport with students,
- communicating clear, challenging learning expectations to each student,
- establishing and maintaining consistent standards of classroom behavior,
- creating a safe environment conducive to learning,
- using instructional time effectively

II.B. Planning 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,
- Pennsylvania Academic standards,
- student learning and motivation, with emphasis on individual differences and diversity
- the community and community resources,
- current education standards and practices

II.C. Selecting, analyzing, modifying and incorporating instructional materials to meet the learning needs and reading level of diverse learners, including:

- curriculum resources and technology,
- inquiry based laboratory experiences,
- information from the internet, professional organizations, and business and industry

II.D. Monitoring student progress and performance and adjusting instructional strategies through a variety of assessment tools in order to provide student feedback, and strengthen the effectiveness and quality of instruction for improved student learning

III. Professionalism

The professional education program provides evidence that Chemistry certification candidates demonstrate knowledge and competencies that foster professionalism in school and community including:

III.A. Professional organizations and associations, professional publications and journals

III.B. Integrity and ethical behavior, professional conduct as stated in Pennsylvania's Code of Professional Practice and Conduct for Educators; and local, state, and federal laws and regulations

III.C. Cultivating professional relationships and collaborating with school colleagues, organizations and other community agencies to improve student learning

III.D. Communicating effectively with parents/guardians, business and industry, and other agencies, and the community at large to support learning by all students