Physics - Jurisdiction Specific Requirements (JSR)

Minnesota

Subpart 1. Scope of practice. A teacher of chemistry, earth and space science, life science, or physics is authorized to provide instruction in all science disciplines to students in grades 5 through 8 and either chemistry, earth and space science, life science, or physics, and integrated science offerings, to students in grades 9 through 12. The science discipline that the teacher is qualified to teach in grades 9 through 12 shall be identified on the teacher's license.

Subp. 2. Licensure requirements. A candidate for licensure to teach science to students in grades 5 through 12 shall:

A. hold a baccalaureate degree from a college or university that is accredited by the regional association for the accreditation of colleges and secondary schools;

B. demonstrate the standards for effective practice for licensing of beginning teachers in part 8700.2000; and

C. show verification of completing a preparation program approved under chapter 8705 leading to the licensure of teachers of science in grades 5 through 8 in subpart 3 and chemistry, earth and space science, life science, or physics in grades 9 through 12 in subpart 4, 5, 6, or 7.

Subp. 2a. Exception for candidates with partial science teaching qualification. The board shall issue a license valid for teaching chemistry, earth and space science, life science, or physics in grades 9 through 12 for candidates who complete the requirements of subpart 2, items A and B; and subpart 4; 5; 6; or 7, but have not completed subpart 3. The board shall issue a license to teach all sciences in grades 5 through 8 to a candidate who has completed the requirements of subparts 2, items A and B, and 3 but has not completed subpart 4, 5, 6, or 7. Licenses issued to teach all sciences in grades 5 through 8 under this exception or as a science specialty under part 8710.3200 are not valid for teaching integrated science offerings above grade 9.

Subp. 7. Subject matter standards for teachers of physics. A candidate for licensure as a teacher of physics in grades 9 through 12 must complete a preparation program under subpart 2, item C, that must include the candidate's demonstration of the knowledge and skills in items A to C, and subpart 3, items E and F.

A. A teacher of physics must demonstrate a conceptual understanding of physics. The teacher must:

(1) use sources of information to solve unfamiliar quantitative problems and communicate the solution in a logical and organized manner as evidenced by the ability to:

(a) describe, in terms of the known and unknown quantities, a given problem in the appropriate pictorial, graphical, or written form;

(b) qualitatively describe, in appropriate physics terms using motion diagrams, vector force diagrams, energy or momentum diagrams, ray diagrams, or field diagrams as necessary, a given problem situation;

(c) mathematically describe, in terms of the relevant numerical, algebraic, and trigonometric quantities and equations, a given problem;

(d) plan, using words, diagrams, and mathematical relationships, a solution for solving a given problem and verify the solution;

(e) implement, using algebra and manipulation and solution of coupled sets of linear equations, quadratic equations, simple differential equations, and simple integrals as necessary, a solution to a given problem; and

(f) evaluate, in terms of unit consistency, reasonableness, and completeness of solution, the solution of a given problem;

(2) use computers to display and analyze experimental and theoretical data as evidenced by the ability to:

(a) graphically describe data using a computer;

(b) design a mathematical model to provide a reasonable fit to a given set of data;

(c) compute and evaluate the statistical significance of mean and standard deviation for a distribution of data;

(3) estimate common physical properties as evidenced by the ability to:

(a) describe numerically, using reasonable physical estimates, the physical properties of common objects; and

(b) compute and evaluate the reasonableness of calculated physical parameters of common objects; and

(4) develop a plan to ensure a safe environment and practices in all physics learning activities.

B. A teacher of physics must demonstrate a knowledge of physics concepts. The teacher must:

(1) understand linear and rotational motion as evidenced by the ability to:

(a) perform measurements and calculations to describe the linear and angular position, velocity, and acceleration of a given object; the forces and torques acting on an object; and the energy, momentum, and angular momentum of a system before and after an interaction;

(b) describe, using words, pictures and diagrams, graphs, vectors, and mathematical relationships, the motion of a given object;

(c) describe, using words, free-body vector diagrams, and mathematical relationships, the forces acting on each object in a given system of interacting objects and explain, using Newton's Second and Third Laws, the relationships between all the forces;

(d) describe, using words, energy diagrams or graphs, and mathematical relationships, the change of energy of a system and any transfer of energy into or out of a given system of interacting objects;

(e) describe, using words, vector diagrams, and mathematical relationships, the change of linear or angular momentum of a given system and any transfer of momentum into or out of the system of interacting objects;

(f) explain and predict qualitatively and quantitatively, in terms of Newton's Laws, the conservation of energy, and the conservation of momentum, the motion of objects in a given system of interacting objects; and

(g) design a strategy for making an object move in a given way;

(2) understand simple harmonic and wave motion as evidenced by the ability to:

(a) perform measurements and calculations to describe the wavelength, amplitude, period, frequency, and energy of a traveling wave or an object in simple harmonic motion;

(b) describe, using words, force diagrams, energy diagrams or graphs, motion graphs, and mathematical relationships, simple or damped harmonic motion or resonance of a given oscillating system;

(c) explain and predict qualitatively and quantitatively, using the equation of motion, changes in motion of an oscillator in a given system when the intrinsic characteristics of the oscillator change, when a given external force is applied to the oscillator, and when the oscillator loses energy to its surroundings;

(d) design, using words, diagrams or graphs, and mathematical relationships, a system which oscillates at a given frequency or exhibits damped oscillations;

(e) describe a traveling or standing wave in a given medium;

(f) explain and predict qualitatively and quantitatively, using the wave equation of motion and the superposition principle, changes in wave motion when a given traveling wave interacts with a given object or boundary;

(g) explain and predict qualitatively and quantitatively, using the wave equation of motion and the superposition principle, changes in wave motion when a given traveling wave interacts with a second wave; and

(h) explain and predict qualitatively and quantitatively, using the wave equation of motion and the superposition principle, changes in the wave when the source and detector are moving relative to each other;

(3) understand electricity and magnetism as evidenced by the ability to:

(a) perform measurements and calculations to describe time varying or constant values of current, voltage, and power in electric circuits and in magnetic fields;

(b) describe, using words, circuit diagrams, graphs, and mathematical relationships, the current, voltage, resistance, capacitance, or inductance of a given system of circuit elements;

(c) explain and predict qualitatively and quantitatively, using the conservation of charge and the conservation of energy, the current through or the voltage across each element in a given circuit when changes are made to the circuit;

(d) design a circuit in which the current varies in a given way;

(e) explain and predict qualitatively and quantitatively, in terms of Newton's laws and the Lorentz Force, the motion of charges in given electric and magnetic fields;

(f) predict qualitatively and quantitatively, using Gauss's law or Ampere's law, the electric field around a given simple geometric distribution of charges and the magnetic field around a given simple geometric system of current-carrying wires;

(g) predict qualitatively, using Lenz's law and Faraday's Law, the induced currents from a given changing magnetic flux;

(h) design, using simple materials, a working electric motor and an air-core electromagnet that produces a field strength; and

(i) explain, in terms of the motion of charges and the electromagnetic nature of light, how electromagnetic radiation is generated in a given situation;

(4) understand physical and geometrical optics as evidenced by the ability to:

(a) perform measurements and calculations to describe light intensity and polarization of a given light source, the location of images formed by a simple mirror and lens system, and the focal length and magnification of a curved mirror or thin lens;

(b) describe, using words, ray diagrams, graphs, and mathematical relationships, the reflection, refraction, transmission, and absorption of light when it encounters a given macroscopic object, a plane or curved mirror, a boundary between mediums of different indices of refraction, a linear polarizer, a prism, and thin concave and convex lenses;

(c) explain and predict qualitatively and quantitatively, in terms of ray diagrams and the laws of reflection and refraction of light, the location and magnification of a real or virtual image for a given system of mirrors or lenses;

(d) design a system of lenses and mirrors to produce a real or virtual image of a given magnification;

(e) describe, using words, diagrams, and graphs, the interaction of monochromatic light with a given single or pair of parallel slits and with thin films; and

(f) explain and predict qualitatively and quantitatively, using the behavior of waves and the principle of superposition, the change in the resulting light pattern with given changes in slit width, separation, and the wavelength of the incident light on a system of slits;

(5) understand the kinetic-molecular model of matter and thermodynamics as evidenced by the ability to:

(a) perform measurements and calculations to describe the mass, volume, density, temperature, and heat capacity of a solid, liquid, or gas at constant pressure and the pressure in a gas;

(b) explain qualitatively, using the kinetic-molecular model of matter, a common physical change;

(c) describe, using words, graphs, and mathematical relationships, changes in pressure, volume, or temperature of an ideal gas;

(d) predict, using the First Law of Thermodynamics, the final temperature of a given thermally isolated system of interacting objects and materials;

(e) explain and predict qualitatively and quantitatively, using the First Law of Thermodynamics, the transfer of heat into or out of a given system;

(f) explain, using the First Law of Thermodynamics, the changes of pressure, temperature, and volume for a monatomic ideal gas operating in a Carnot cycle between given states, and describe quantitatively, using words, graphs, and mathematical relationships, the thermal efficiency of the system; and

(g) explain, in terms of the second law of thermodynamics, why energy flows from hot to cold objects; and

(6) understand contemporary physics as evidenced by the ability to:

(a) perform measurements and calculations to detect nuclear radiation in the environment, and determine wavelengths and energy of the emission spectrum of a given gas;

(b) describe, using words, diagrams, and mathematical relationships, the time dilation, length contraction, and momentum and energy of an object of given velocity;

(c) describe, using words, diagrams, and tables, the basic atomic and subatomic constituents of matter;

(d) explain qualitatively, in terms of the standard model, the observed interaction between atomic or subatomic particles in a simple situation;

(e) explain qualitatively, using the quantum nature of light and matter, and the conservation of energy and momentum, the observed interaction between photons and matter in a given situation;

(f) explain, using conservation principles, the observed changes in the matter and energy of a given nuclear process;

(g) predict, using the Heisenberg Uncertainty Principle, the lower limit of size, momentum, energy, or time that could be expected in a given atomic or subatomic measurement or situation; and

(h) describe, in terms of the energy bands and levels in the material, the electrical conductivity of a given conductor, insulator, or semiconductor.

C. A teacher of physics must demonstrate an advanced conceptual understanding of physics and the ability to apply its fundamental principles, laws, and concepts by completing a full research experience. The teacher must:

(1) identify various options for a research experience including independent study projects, participation in research with an academic or industry scientist, directed study, internship, or field study;

(2) select an option and complete a research experience that includes conducting a literature search on a problem;

(3) design and carry out an investigation;

(4) identify modes for presenting the research project; and

(5) present the research project in the selected mode.

Minn. R. 8710.4750

Delaware

Out-of-state program must be NCATE/CAEP accredited or "equivalent" to NCATE/CAEP standards.
4.0 Prescribed Education, Knowledge, and Skill Requirements
4.1 For an applicant who does not hold a content area Standard Certificate, the applicant shall have satisfied the requirements in subsections 4.1.1 and 4.1.2.
4.1.1 The applicant shall have:

4.1.1.1 Obtained and currently maintain a Science certificate in the secondary science curricular area sought from the National Board for Professional Teaching Standards; or
4.1.1.2 Earned a bachelor's degree from a Regionally Accredited college or university with a minimum of 30 semester hours of coursework in secondary science education from an educator preparation program approved or recognized by the National Council for the Accreditation of Teacher Education (NCATE), the Council for the Accreditation of Educator Preparation (CAEP), or a state where the state approval body employed the appropriate standards; or
4.1.1.3 Satisfactorily completed an alternative routes for licensure or certification program to teach secondary science as provided in 14 Del.C. §§ 1260 -- 1266; or
4.1.1.4 Satisfactorily completed a Department-approved educator preparation program in secondary science education.

4.1.2 The applicant shall have achieved a Passing Score on the Praxis Subject Assessment as provided in subsections 4.1.2.1 through 4.1.2.5.

4.1.2.1 For a Secondary Science Teacher Standard Certificate -- Biology, the applicant shall have achieved on the Praxis Subject Assessment -- Biology: Content Knowledge (ETS Test Code #5235) a Passing Score of 150.
4.1.2.2 For a Secondary Science Teacher Standard Certificate -- Chemistry, the applicant shall have achieved on the Praxis Subject Assessment -- Chemistry: Content Knowledge (ETS Test Code #5245) a Passing Score of 151.
4.1.2.3 For a Secondary Science Teacher Standard Certificate -- Physics, the applicant shall have achieved on the Praxis Subject Assessment -- Physics: Content Knowledge (ETS Test Code #5265) a Passing Score of 140.
4.1.2.4 For a Secondary Science Teacher Standard Certificate -- Earth Science, the applicant shall have achieved on the Praxis Subject Assessment -- Earth and Space Sciences: Content Knowledge (ETS Test Code # 5235 5435) a Passing Score of 150.
4.1.2.5 For a Secondary Science Teacher Standard Certificate -- Integrated or Physical Science, the applicant shall have achieved on the Praxis Subject Assessment -- General Science: Content Knowledge (ETS Test Code #5235) a Passing Score of 151.

4.2 For an applicant who holds at least one content area Standard Certificate, the applicant shall have achieved a Passing Score on the Praxis Subject Assessment as provided in subsection 4.1.2.
5.0 Application Requirements

5.1 If an applicant is applying for an Initial License, a Standard Certificate must be applied for simultaneously with the application for an Initial License, and the applicant shall also provide all required documentation for the License.

5.2 For applicants who are applying for a Secondary Science Teacher Standard Certificate under subsections 3.1.1 and 4.1, the following documentation is required:

5.2.1 Evidence of obtaining and maintaining a Science certificate from the National Board for Professional Teaching Standards, if applicable; and

5.2.2 Official transcript from the applicant's Regionally Accredited college or university.

5.2.2.1 Electronic transcripts may be submitted by the Employing Authority or by the applicant's Regionally Accredited college or university; or

5.2.2.2 Sealed paper transcripts may be submitted.

5.2.2.3 The Department will not accept copies of transcripts; and

5.2.3 Official score on the Praxis Subject Assessment as provided in subsection 4.1.2; and

5.2.4 Additional documentation as required by the Department.

5.3 For applicants who are applying for a Secondary Science Teacher Standard Certificate under subsections 3.1.1 and 4.2, the following documentation is required:

5.3.1 Official score on the Praxis Subject Assessment as provided in subsection 4.2; and

5.3.2 Additional documentation as required by the Department.

5.4 For applicants who are applying for the Secondary Science Teacher Standard Certificate under 3.1.2, the following documentation is required:

5.4.1 An official copy of the Valid and Current License or Certificate; and

5.4.2 Additional documentation as required by the Department.

Code Del. Regs. 1543

(a) The Department shall issue a standard certificate to an applicant who meets the requirements for licensure and has acquired the prescribed knowledge, skill, or education to practice in a particular area, to teach a particular subject or to instruct a particular category of students. Where applicable and available, an applicant for a standard certificate must have achieved a passing score on an examination of content knowledge, such as Praxis II. This requirement shall apply to all applicants teaching special education in a “core content area,” as defined in § 1210 of this title, in secondary schools.

(b) Notwithstanding the provisions of subsection (a) of this section, the Department shall issue a standard certificate to an applicant who:

(1) Meets the requirements for licensure and holds a valid and current license or certificate from another state; or

(2) Meets the requirements for a Meritorious New Teacher candidate designation adopted pursuant to § 1203 of this title.

Del. Code Ann. tit. 14, § 1220 (West)

Idaho

Out-of-state program must be NCATE/TEAC/CAEP accredited.
Idaho Admin. Code r. 08.02.02.024
08. Physics (5-9 or 6-12). Twenty (20) semester credit hours in the area of physics. (7-1-21)T
Idaho Admin. Code r. 08.02.02.015

01. Standard Instructional Certificate. A Standard Instructional Certificate makes an individual eligible to teach all grades, subject to the grade ranges and subject areas of the valid endorsement(s) attached to the certificate. A standard instructional certificate may be issued to any person who has a baccalaureate degree from an accredited college or university and who meets the following requirements: (7-1-21)T

a. Professional education requirements: (7-1-21)T

i. Earned a minimum of twenty (20) semester credit hours, or thirty (30) quarter credit hours, in the philosophical, psychological, methodological foundations, instructional technology, and in the professional subject matter, which shall include at least three (3) semester credit hours, or four (4) quarter credit hours, in reading and its application to the content area; (7-1-21)T

ii. The required minimum credit hours must include at least six (6) semester credit hours, or nine (9) quarter credit hours, of student teaching in the grade range and subject areas as applicable to the endorsement; and (7-1-21)T

b. Completed an approved educator preparation program and have an institutional recommendation from an accredited college or university specifying the grade ranges and subjects for which they are eligible to receive an endorsement in; (7-1-21)T

c. Individuals seeking endorsement must complete preparation in at least two (2) fields of teaching. One (1) of the teaching fields must consist of at least thirty (30) semester credit hours, or forty-five (45) quarter credit hours and a second field of teaching consisting of at least twenty (20) semester credit hours, or thirty (30) quarter credit hours. Preparation of not less than forty-five (45) semester credit hours, or sixty-seven (67) quarter credit hours, in a single subject area may be used in lieu of the two (2) teaching field requirements; (7-1-21)T

d. Proficiency in areas noted above is measured by completion of the credit hour requirements provided herein. Additionally, each candidate must meet or exceed the state qualifying score on the state board approved content area and pedagogy assessments. (7-1-21)T

e. The Standard Instructional Certificate is valid for five (5) years. Six (6) semester credit hours are required every five (5) years in order to renew the certificate. (7-1-21)T

Wisconsin

Wisconsin standards are aligned with CAEP (and relevant SPA) standards.

Wis. Adm. Code § PI 34.040 (g) Out--of--state program. The applicant meets all of the following requirements: 1. Completed an out--of--state educator preparation program that meets all of the following requirements: a. Is approved by the state education agency of the state in which it is located. b. Is comparable to an approved program, including student teaching experience. 2. Received an institutional endorsement from the preparation program. 3. Demonstrated content knowledge by meeting the requirements under s. PI 34.021 (1) (c). 4. Demonstrated pedagogical knowledge, as required under s. PI 34.021 (1) (d).

Wis. Adm. Code § PI 34.002 Except as otherwise provided in this chapter, to receive a license to teach under subch. VI, an applicant shall complete an approved program and demonstrate proficient performance in the knowledge, skills, and dispositions in all of the following: (1) PUPIL DEVELOPMENT. The teacher understands how pupils grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas. The teacher designs and implements developmentally appropriate and challenging learning experiences for pupils. (2) LEARNING DIFFERENCES. The teacher uses his or her understanding of individual pupil differences and diverse cultures and communities to ensure inclusive learning environments that enable each pupil to meet high standards. (3) LEARNING ENVIRONMENTS. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self--motivation. (4) CONTENT KNOWLEDGE. The teacher understands the central concepts, tools of inquiry, and structures of each discipline he or she teaches. The teacher creates learning experiences that make the discipline accessible and meaningful for pupils to assure mastery of the content. (5) APPLICATION OF CONTENT. The teacher understands how to connect concepts and use differing perspectives to engage pupils in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues. (6) ASSESSMENT. The teacher understands and uses multiple methods of assessment to engage pupils in their own growth, to monitor pupil progress, and to guide the teacher's and pupil's decision making. (7) PLANNING FOR INSTRUCTION. The teacher plans instruction that supports every pupil in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross--disciplinary skills, pedagogy, pupils, and pupils' communities. (8) INSTRUCTIONAL STRATEGIES. The teacher understands and uses a variety of instructional strategies to encourage pupils to develop a deep understanding of content areas and their connections, and to develop skills to apply knowledge in a meaningful way. (9) PROFESSIONAL LEARNING AND ETHICAL PRACTICE. The teacher engages in ongoing professional learning. The teacher uses evidence to continuously evaluate the teacher's practice, including the effects of the teacher's choices and actions on pupils, their families, other educators, and the community. The teacher adapts the teacher's practice to meet the needs of each pupil. (10) LEADERSHIP AND COLLABORATION. The teacher seeks appropriate leadership roles and opportunity

in order to take responsibility for pupil learning, to collaborate with pupils, their families, educators, and the community, and to advance the profession.

Connecticut

Conn. Agencies Regs. 10-145d-451
On and after July 1, 1993, to receive an initial educator certificate for secondary academic subjects an applicant shall present evidence of meeting the following requirements in addition to meeting assessment requirements, as appropriate:

(a) Holds a bachelor's degree from an approved institution;
(b) Has a minimum of 39 semester hours of credit in general academic courses in five of the six areas listed below. A course in United States history. On and after July 1, 1998, a survey course in United States history comprised of not fewer than three semester hours of credit shall be included.

(1) English;
(2) Natural sciences;
(3) Mathematics;
(4) Social studies;
(5) Foreign language; and
(6) Fine arts;

(c) Has completed a subject-area major consisting of one of the following:

(1) A major awarded by an approved institution in the subject area for which certification is sought, except that a major in professional education may not be accepted in fulfillment of this requirement; or

(2) A minimum of 30 semester hours of credit in the subject for which endorsement is sought and a minimum of nine semester hours of credit in a subject or subjects related to the subject for which endorsement is sought, except that a major or course work in professional education may not be accepted in fulfillment of this requirement, and except that:

(A) For the general science endorsement, a major consisting of a minimum of 39 semester hours of credit in science including study in biology, chemistry, physics and earth science;
(B) For the history and social studies endorsement:

(i) A major awarded by an approved institution in history, except that on and after July 1, 1998, 18 semester hours of credit in social studies shall be included; or

(ii) A major in political science; economics; geography; anthropology or sociology including at least 18 semester hours of credit in history, or

(iii) An interdisciplinary major consisting of 39 semester hours of credit in subjects covered by the endorsement, each of which shall include 18 semester hours of credit in history including United States history, western civilization or European history and nonwestern history, provided that for the interdisciplinary major, study shall include a minimum of one course in each of the following areas: political science; economics; geography; sociology or anthropology or psychology;

(C) For the business endorsement, a major awarded by an approved institution in business or in any one of the subjects covered by the endorsement or an interdisciplinary major consisting of 39 semester hours of credit in subjects covered by the endorsement;
(D) For a foreign language endorsement, 24 semester hours of credit in the foreign language in which endorsement is sought; and

(4) Has a minimum of 18 semester hours of credit in professional education in a planned program of study and experience to be distributed among each of the following:

(A) Foundations of education. This group includes areas such as: (1) philosophy of education, (2) school effectiveness, (3) history of education and (4) comparative education;

(B) Educational psychology. This group includes areas such as: (1) growth and development of children from birth through the life span, (2) psychology of learning, (3) child-adolescent psychology and (4) mental hygiene;

(C) Curriculum and methods of teaching. This group includes areas such as: (1) subject area curriculum and methodology and (2) effective teaching skills;

(D) Supervised observation, participation and full-time responsible student teaching in a secondary school totaling at least six but not more than 12 semester hours of credit as part of the requirement; and

(E) A course of study in special education comprised of not fewer than 36 clock hours, which shall include study in understanding the growth and development of exceptional children, including handicapped and gifted and talented children and children who may require special education, and methods for identifying, planning for and working effectively with special-needs children in the regular classroom.

Iowa

Iowa Admin. Code 282-13.28
13.28(17) Science.
g. Physics.
(1) 5-12. Completion of 24 semester hours in physics or 30 semester hours in the broad area of science to include 15 semester hours in physics.
(2) For holders of the mathematics 5-12 endorsement, completion of:
1. 12 credits of physics to include coursework in mechanics, electricity, and magnetism; and
2. A methods class that includes inquiry-based instruction, resource management, and laboratory safety.
(3) For holders of the chemistry 5-12 endorsement, completion of 12 credits of physics to include coursework in mechanics, electricity, and magnetism.

Nebraska

Neb. Admin. R. & Regs. Tit. 92, Ch. 24, § 006
006.40C Persons with this endorsement may teach any physics course in grades 7 through 12.
006.40D Certification Endorsement Requirements: This endorsement requires a minimum of 36 semester hours of laboratory based courses in the natural sciences (biology, chemistry, Earth and space science, and physics), of which 24 semester hours must be in physics, and a minimum of 12 semester hours of laboratory based courses among the remaining three natural sciences areas. A laboratory-based course provides activity-based, hands-on experience for all students. Laboratory activities will be designed to allow students to develop scientific skills and processes, discover and construct science concepts, and allow for the application of the concept to the real lives of students.

New Hampshire

N.H. Code Admin. R. Ed 507.30
(c) In addition to meeting the requirements for certification under Ed 507.28 for science teacher for grades 5-8, Ed 507.30 for earth and space science teacher, Ed 507.31 for life sciences teacher, Ed 507.32 for chemistry teacher, Ed 507.33 for physics teacher, or Ed 507.51 for physical science teacher for grades 7-12, a science teacher shall have the qualifications listed in (d) and (e) below.
(d) In the area of instructional performance, the candidate shall demonstrate:

(1) Proficiency in the use of scientific methods as demonstrated by the ability to:
a. Integrate the science practices throughout lessons by:

1. Asking questions for science and defining problems for engineering;
2. Developing and using models;
3. Planning and carrying out investigations;
4. Analyzing and interpreting data;
5. Using mathematics and computational thinking;
6. Constructing explanations for science and designing solutions for engineering;
7. Engaging in argument from evidence; and
8. Obtaining, evaluating, and communicating information;

b. Design and teach grade level appropriate laboratory activities incorporating scientific processes, promoting scientific habits of mind, and meeting needs of diverse learners;
c. Use scientific drawings, diagrams, data tables, models, and graphing essential to science investigations and expression of ideas;
d. Design learning activities fostering questioning, open-ended investigations, the development of cooperative group skills, and promoting practice in decision making and problem solving;
e. Use methods of teaching reading, writing, communication, and study skills essential to the effective mastery of grade level science content;
f. Design activities and investigations integrating appropriate quantitative literacy skills and concepts; and
g. Organize, present, and evaluate science ideas in a manner emphasizing conceptual understanding of phenomena and optimizing learning experiences for students of all ability levels and learning styles; and
(2) Scientific content knowledge that enables the integration of the common themes exhibited in all of the sciences into teaching and course design including:

a. Systems and system models;
b. Energy and matter;
c. Cause and effect;
d. Scale, proportion, and quantity;
e. Patterns of change, including constancy or stability;
f. Structure and function;
g. Stability, change, and evolution; and
h. Nature of science and inquiry;

(3) The ability to make connections that:

a. Establish relationships among all sciences and reflect the role of science systems in science literacy;

b. Relate the sciences to technological issues that influence society and the ethical and moral consequences of decisions related to those issues; and

c. Integrate knowledge from the history and philosophy of science into science instruction;

(4) Knowledge of field and laboratory safety and emergency procedures, including responsibilities of science teachers for:

a. The welfare of their students and care for organisms as appropriate to the area of study using the "Position Statement on the Responsible Use of Live Animals and Dissection in the Science Classroom", March 2008, available as specified in Appendix II; and

b. The proper maintenance, storage and disposal of laboratory materials or chemicals using the Globally Harmonized System for Hazard Communication of 2007 available as specified in Appendix II;

(5) Knowledge and skills to integrate technological tools for learning, analysis and reporting, including, but not limited to:

a. Skills to plan, design, deliver, and incorporate active learning and collaboration;

b. Collect and analyze data using information technology; and

c. Communicate information effectively;

(6) Knowledge and skills of computing and computational thinking as it relates to science, including, but not limited to:

a. Visualizations of scientific concepts; and

b. Modeling and simulating engineering design to communicate science understanding; and

(7) Ability to practice good digital citizenship and model safe, ethical, and legal practice with digital tools and resources.

(e) The candidate shall demonstrate knowledge of the organizations, agencies, and journals that contribute to the professional growth of the science teacher.

N.H. Code Admin. R. Ed 507.34

(c) A candidate for certification as a physics teacher for grades 7-12 shall have skills, competencies, and knowledge in the following areas:

(1) In the area of fundamental content knowledge, the candidate shall have the ability to:

a. Comprehend, apply, quantify, evaluate, analyze, and synthesize specific physics knowledge of:

1. Energy, including kinetic, potential, heat, and rest;

2. Newtonian principles and laws as they apply to statics and dynamics, including, but not limited to, friction, inclines, circular motion, the rotation of rigid bodies, and fluid mechanics and knowledge of how these principles are used in engineering applications;

3. Thermodynamics, including the ideal gas law, entropy, heat engines, and thermodynamic cycles, kinetic, and ensemble theory;

4. Conservation laws and the relationships between conserved quantities, including the conservation of energy, mass, linear and angular momentum, and charge;

5. Classical wave theory of sound and electromagnetism, including the electromagnetic spectrum, optics, and light behavior;
6. Electricity, electrostatics, electrodynamics, and magnetism, including, but not limited to, circuit theory and the propagation and generation of electric and magnetic fields;
7. Fundamental forces of gravity, electromagnetism, weak nuclear force, and strong nuclear force including, but not limited to, the spectrum of known fundamental particles, the standard model, and its known shortcomings;
8. Nuclear physics, including, but not limited to reactivity, radioactivity, nuclear reactors, fission, and fusion;
9. Quantum mechanics, including wave-particle duality and special relativity, Lorentz transformations, time dilations, length contraction, and conversion of rest mass into energy;
10. Applications of physics in environmental quality and to personal and community health;

b. Applications of physics for design, engineering, and technology in society, business, industry, and health fields;

c. Apply knowledge of physics and physical science concepts through full and partial inquiries, laboratory investigations, and the use of scientific models; and

d. Understand and be able to apply mathematical concepts and techniques, including, but not limited to modeling and vector and variable analysis at least through the level of college calculus and statistics.

New Jersey

Degree Requirement

- A minimum of a bachelor's degree is required from a regionally accredited college/university.

Cumulative GPA Requirement

- New Jersey requires that candidates for certification achieve a cumulative GPA of at least 3.0 when a GPA of 4.00
equals an A grade for students graduating on or after September 1, 2016 (2.75 for those graduating before
September 1, 2016) in a baccalaureate degree program, higher degree program or a State-approved postbaccalaureate certification program with a minimum of 13 semester-hour credits.
- Please note that there are GPA Flexibility Rules where a high praxis score may offset a GPA that is lower than 3.0, but
higher than 2.75.

Subject Matter Preparation

- For certification as a Physics teacher, current regulations require that applicants complete a minimum of 30 credits in a
coherent sequence in the subject field of Physics. A coherent sequence requires that at least 12 credits are completed
at the advanced level of study (junior, senior or graduate level). Examples of courses accepted for Physics include
physics, mechanics, electrical engineering majors, analytic physics, statics, circuit designs and mechanical
designs. Related courses may be accepted depending on the course description/content. Please provide a course
description if a course is not taken from the Physics Department. Courses in pedagogy/education are not accepted
towards the subject matter preparation. The final determination as to which courses will be counted towards the Physics
subject matter is based on professional and content standards found in the NJ Licensing Code. All credits must appear
on a regionally accredited 2 or 4-year college/university transcript.

New Mexico

Official sealed transcripts reflecting completion of a Bachelor's degree from a regionally accredited college or university; and 24 semester hours of Secondary education course work, 12 semester hours of which must be in upper division courses, to include student teaching; and 24 semester hours in teaching field such as language arts, social studies, math, etc; and 3 semester hours in teaching reading for those who first entered any college or university on or after August 1, 2001

US Virgin Islands

For initial certification in the U.S. Virgin Islands, all candidates must:

- Earn a baccalaureate degree.
- Submit appropriate applications.
- Submit official transcripts from all accredited institutions.
- Demonstrate proof of U.S. citizenship, permanent residency or other approved work status.
- Complete a course in U.S. Virgin Islands history within the first year of employment.
- Pass the Praxis® tests for their certification area.
- According to the U.S. Virgin Island's Board of Education's Certification document, there are also general course requirements for any person who would like to teach in the U.S. Virgin Islands. Elementary school teachers need 36 education credits, and secondary school teachers need 26 education credits.

The areas are:

1. Foundations of Education. (This group includes areas such as philosophy of Education, school effectiveness, history of education, and comparative education);
2. Educational Psychology (This group includes such areas as growth and development of children from birth through life span, psychology of learning, child-adolescent psychology and mental hygiene);
3. Curriculum and Methods (This group includes a minimum of [18 for elementary, 8 for secondary] semester hours of credit in teaching language arts, reading, mathematics, fine arts, science, social studies, and effective teaching skills, classroom management, measurement and evaluation);
4. Educational Technology;
5. Special Education;
6. Student Teaching (supervised observation, participation and full-time responsible teaching in an elementary school, totaling at least 6 but not more than 12 semester hours of credit). Teachers who have taught in the Virgin Islands public school system with satisfactory or better evaluations for five consecutive years do not have to complete a student teaching course. This applies only to teachers hired in 1997 or before.

All teachers must have a minimum of a Bachelor's Degree, and secondary school teacher applicants must possess a minimum of a college major and/or 30 credits in a content area. Secondary school applicants with less than 30 credits in their content area, but more than 15 credits in that area, can take the Praxis II exam in that subject area to show content area competency.

Vermont

5440-13 Science
The holder is authorized to teach science in grades 7-12.
1. The Learner and Learning

1.1. Learning Environments
Effective science Educators are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with Vermont state science standards. Instructional plans reflect the nature of science and three-dimensional learning that integrates Disciplinary Core Ideas, Science and Science and Engineering Practices, and Crosscutting Concepts. Instructional plans reflect the nature and social context of science, and inquiry. Educators design and select learning activities, instructional settings, and resources--including science-specific technology--to achieve those goals.

1.1.1. Educators use a variety of instructional strategies that demonstrate knowledge and understanding of how to select the appropriate teaching and learning activities -- including laboratory or field settings and applicable instruments and/or technology--to allow all students to learn. These strategies are inclusive and motivating for all students.

1.1.2. Educators create a knowledge-building culture that encourages intellectual risk-taking and provides a safe environment for students to propose solutions and explore the accuracy of their explanations.

1.1.3. Educators develop learning opportunities where students construct explanations for observed phenomena and find evidence to support these explanations or design solutions to engineering problems.

1.1.4. Educators provide students with equitable opportunities to develop their scientific understandings of the Vermont state science standards.

1.2. Physical Safety
Effective science Educators can demonstrate and maintain safety procedures, chemical safety, and the ethical treatment of living organisms.

1.2.1. Design activities that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all instructional materials.

1.2.2. Design and demonstrate activities that show an ability to implement emergency procedures and the maintenance of safety equipment, policies, and procedures that comply with established state and/or national guidelines. Educators ensure safe activities appropriate for the abilities of all students.

1.2.3. Design and demonstrate activities that show ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.

2. Content Knowledge and Skills

2.1. Educators demonstrate understanding of the major concepts, principles, theories, laws, and interrelationships of the major fields of science and the supporting roles of science-specific technology.

2.1.1. Physical Science

2.1.1.1. Matter and Its Interactions

2.1.1.2. Motion and Stability: Forces and Interactions

2.1.1.3. Energy and Waves

2.1.2. Life Science

2.1.2.1. From Molecules to Organisms: Structures and Processes

2.1.2.2. Ecosystems: Interactions, Energy, and Dynamics

2.1.2.3. Heredity: Inheritance and Variation of Traits

2.1.2.4. Biological Evolution: Unity and Diversity

2.1.3. Earth & Space Sciences

2.1.3.1. Earth's Place in the Universe

2.1.3.2. Earth's Systems

2.1.3.3. Earth and Human Activity

2.1.4. Engineering Design Process (N.B., This does not refer to engineering content, but an understanding of how to integrate engineering design processes across science disciplines.)

3. Instructional Practice

Effective science Educators understand how students learn and develop scientific knowledge. They strive to develop students' deep understanding of core scientific principles rather than a cursory understanding of discrete facts. Educators integrate Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts to develop this knowledge for all students.

3.1. Pedagogical Content Knowledge

3.1.1. Educators provide opportunities for students to engage in scientific thinking that involves collecting and interpreting data to evaluate their understandings and develop scientific explanations. Applications of science-specific technology are included in the lessons where appropriate.

3.1.2. Educators create opportunities for students to collaboratively design and implement scientific investigations, present and discuss the results of their investigations, construct explanations, and solve engineering problems.

3.1.3. Educators design instruction and assessment strategies that elicit misconceptions and cause students to confront and question their emergent scientific ideas. Educators leverage student misconceptions to personalize future instruction.

3.2. Three-dimensional Learning

3.2.1. Instruction addresses Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts concurrently around an identified scientific idea or engineering problem.

3.2.2. Educators design learning opportunities where students explore a Disciplinary Core Idea through Science and Engineering Principles and make connections to the Crosscutting Concepts.

3.3. Assessment

Effective science Educators:

3.3.1. Plan fair and equitable assessment strategies that integrate three-dimensional learning to analyze student learning and evaluate how the learning goals are met.

3.3.2. Design formative, interim, and summative assessment strategies to continuously evaluate preconceptions and ideas that students hold and how these ideas evolve.

3.3.3. Scaffold student learning to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.

4. A major in biology, chemistry, physics, or earth/ environmental/ atmospheric sciences, or the equivalent in undergraduate and/or graduate coursework. For the full endorsement, a candidate must have at least one course that addresses each content knowledge area; a single class could potentially address multiple areas.

5. A minimum of a practicum, or the equivalent, at the middle/secondary level (7-12) in an endorsement requiring competency with the Core Teaching Standards.

6. Required Testing: Praxis II Subject Assessment: General Science - Test Code 5435. Candidates must achieve a passing score on the General Science test AND one Science subject specific test.

Biology - Test Code 5235

Chemistry - Test Code 5245

Physics - Test Code 5265

Earth Science - Test Code 5571

Virginia

8 VAC 20-23-480
Endorsement requirements. The candidate shall have:
1. Earned a baccalaureate degree from a regionally accredited college or university and graduated from an approved teacher preparation program in chemistry;
2. Earned a baccalaureate degree from a regionally accredited college or university and completed a major in chemistry or 32 semester hours in chemistry, including at least one course in each of the following areas: inorganic chemistry, organic chemistry, physical chemistry, biochemistry, and analytical chemistry and other preparation consistent with the competencies required for the endorsement; or
3. Earned an endorsement in another science discipline and completed at least 18 semester hours in chemistry, including at least one course in each of the following areas: inorganic chemistry, organic chemistry, physical chemistry, biochemistry, and analytical chemistry.

8 VAC 20-23-190
Professional studies requirements for preK-12, secondary grades 6-12, and adult education endorsements: 18 semester hours. Professional studies requirements for special education endorsements: 21 semester hours. These requirements may be taught in integrated coursework or modules.
1. Human development and learning (birth through adolescence): 3 semester hours.
    a. Skills in this area shall contribute to an understanding of the physical, social, emotional, speech and language, and intellectual development of children and the ability to use this understanding in guiding learning experiences and relating meaningfully to students.
    b. The interaction of children with individual differences - economic, social, racial, ethnic, religious, physical, and cognitive - should be incorporated to include skills contributing to an understanding of developmental disabilities and developmental issues related to, but not limited to, low socioeconomic status; attention deficit disorders; developmental disabilities; gifted education, including the use of multiple criteria to identify gifted students; substance abuse; trauma, including child abuse and neglect and other adverse childhood experiences; and family disruptions.
2. Curriculum and instruction: 3 semester hours.
    a. Skills in this area shall contribute to an understanding of the principles of learning; the application of skills in discipline-specific methodology; varied and effective methods of communication with and among students; selection and use of materials, including media and contemporary technologies; selection, development, and use of appropriate curricula, methodologies, and materials that support and enhance student learning and reflect the research on unique, age-appropriate, and culturally relevant curriculum and pedagogy.
    b. Understanding of the principles of online learning and online instructional strategies and the application of skills to deliver online instruction shall be included.

c. Instructional practices that are sensitive to culturally and linguistically diverse learners, including English learners; gifted and talented students and students with disabilities; and appropriate for the level of endorsement sought shall be included.

d. Teaching methods shall be tailored to promote student academic progress and effective preparation for the Virginia Standards of Learning assessments.

e. Methods of improving communication between schools and families, ways of increasing family engagement in student learning at home and in school, and family engagement with the Virginia Standards of Learning shall be included.

f. Study in child abuse recognition and intervention in accordance with curriculum guidelines developed by the Virginia Board of Education in consultation with the Virginia Department of Social Services and training or certification in emergency first aid, cardiopulmonary resuscitation, and the use of automated external defibrillators shall be included. The certification or training program shall (i) be based on the current national evidenced-based emergency cardiovascular care guidelines for cardiopulmonary resuscitation and the use of automated external defibrillator, such as a program developed by the American Heart Association or the American Red Cross, and (ii) include hands-on practice of the skills necessary to perform cardiopulmonary resuscitation.

g. Curriculum and instruction for secondary grades 6-12 endorsements shall include middle and secondary education.

h. Pre-student teaching experiences (field experiences) should be evident within these skills. For preK-12, field experiences shall be at the elementary, middle, and secondary levels.

3. Assessment of and for learning: 3 semester hours.

a. Skills in this area shall be designed to develop an understanding and application of creating, selecting, and implementing valid and reliable classroom-based assessments of student learning, including formative and summative assessments. Assessments designed and adapted to meet the needs of diverse learners shall be addressed.

b. Analytical skills necessary to inform ongoing planning and instruction, as well as to understand, and help students understand their own progress and growth shall be included.

c. Skills shall also include the ability to understand the relationships among assessment, instruction, and monitoring student progress to include student performance measures in grading practices, the ability to interpret valid assessments using a variety of formats in order to measure student attainment of essential skills in a standards-based environment, and the ability to analyze assessment data to make decisions about how to improve instruction and student performance.

d. Understanding of state assessment programs and accountability systems, including assessments used for student achievement goal-setting as related to teacher evaluation and determining student academic progress shall be included.

e. Knowledge of legal and ethical aspects of assessment and skills for developing familiarity with assessments used in preK-12 education such as diagnostic, college admission exams, industry certifications, and placement assessments shall be included.

4. Foundations of education and the teaching profession: 3 semester hours.

a. Skills in this area shall be designed to develop an understanding of the historical, philosophical, and sociological foundations underlying the role, development, and organization of public education in the United States.

b. Attention shall be given to the legal status of teachers and students, including federal and state laws and regulations; school as an organization and culture; and contemporary issues and current trends in education, including the impact of technology on education. Local, state, and federal governance of schools, including the roles of teachers and schools in communities shall be included.

c. Professionalism and ethical standards, as well as personal integrity shall be addressed.

d. Knowledge and understanding of Virginia's Guidelines for Uniform Performance Standards and Evaluation Criteria for Teachers shall be included.

5. Classroom and behavior management: 3 semester hours.

a. Skills in this area shall contribute to an understanding and application of research-based classroom and behavior management techniques, classroom community building, positive behavior supports, and individual interventions, including techniques that promote emotional well-being and teach and maintain behavioral conduct and skills consistent with norms, standards, and rules of the educational environment.

b. This area shall address diverse approaches based upon culturally responsive behavioral, cognitive, affective, social and ecological theory and practice.

c. Approaches should support professionally appropriate practices that promote positive redirection of behavior, development of social skills and of self-discipline.

d. Knowledge and an understanding of various school crisis management and safety plans and the demonstrated ability to create a safe, orderly classroom environment shall be included. The link between classroom management and the students' ages shall be understood and demonstrated in techniques used in the classroom.

6. Language and literacy.

a. Adult education, preK-12, and secondary grades 6-12 - literacy in the content areas: 3 semester hours. Skills in this area shall be designed to impart an understanding of vocabulary development and comprehension skills in English, mathematics, science, history and social science, and other content areas. Strategies include teaching students how to ask effective questions, summarize and retell both verbally and in writing, and listen effectively. Teaching strategies include literal, interpretive, critical, and evaluative comprehension, as well as the ability to foster appreciation of a variety of fiction and nonfiction texts and independent reading for adolescent learners.

b. Special education - language acquisition and reading and writing: 6 semester hours. Skills listed for these endorsement areas represent the minimum competencies that a beginning teacher shall be able to demonstrate. These skills are not intended to limit the scope of a beginning teacher's program. Additional knowledge and skills that add to a beginning teacher's competencies to deliver instruction and improve student achievement should be included as part of a quality learning experience.

(1) Language acquisition: 3 semester hours. Skills in this area shall be designed to impart a thorough understanding of the Virginia English Standards of Learning, as well as the complex nature of language acquisition as a precursor to literacy. Language acquisition shall follow the typical development of linguistic competence in the areas of phonetics, semantics, syntax, morphology, phonology, and pragmatics.
(2) Reading and writing: 3 semester hours. Skills in this area shall be designed to impart a thorough understanding of the Virginia English Standards of Learning, as well as the reciprocal nature of reading and writing. Reading shall include phonemic and other phonological awareness, concept of print, phonics, fluency, vocabulary development, and comprehension strategies. Writing shall include writing strategies and conventions as supporting the composing and written expression and usage and mechanics domains. Additional skills shall include proficiency in understanding the stages of spelling development and the writing process and the ability to foster appreciation of a variety of fiction and nonfiction texts and independent reading.
7. Supervised classroom experience. Supervised clinical experiences shall be continuous and systematic and comprised of early field experiences and a minimum of 10 weeks of successful full-time student teaching in the endorsement area sought under the supervision of a cooperating teacher with demonstrated effectiveness in the classroom. The summative supervised student teaching experience shall include at least 150 clock hours spent in direct teaching at the level of endorsement in a public or accredited nonpublic school.

If a preK-12 endorsement is sought, teaching activities shall be at the elementary and middle or secondary levels. Individuals seeking the endorsement in library media shall complete the supervised school library media practicum in a school library media setting. Individuals seeking an endorsement in an area of special education shall complete the supervised classroom experience requirement in the area of special education for which the endorsement is sought. One year of successful full-time teaching experience in the endorsement area in a public or an accredited nonpublic school may be accepted in lieu of the supervised teaching experience. For the Online Teacher License only, one year of successful online teaching experience in the endorsement area in a public school, an accredited nonpublic school, or an accredited virtual school or program may be accepted in lieu of the supervised teaching experience. A fully licensed, experienced teacher shall be available in the school building to assist a beginning teacher employed through the alternate route.