

NSTA Science Content Analysis Form: Secondary Science

Instructions for Preparing for Your Review

Tables provided below include, in the left column, the 2011 NSTA subject matter for each science discipline. In the right hand column, include the name and course number for each relevant course. With licensure requirements varying from state to state, the requirements for each discipline were delineated and placed in separate tables, to include: Competency requirements for all secondary teachers;

- Core competencies required of all teachers in a discipline (biology, chemistry, etc.);
- Advanced competencies required of specialists in a given discipline; and
- Supporting competencies for each discipline in the other sciences and mathematics.

Include the tables relevant to your licensure area. Use this table to decide on that mix. Note that there are choices to demonstrate alignment with the NSTA Content Standard Requirement, NSTA 2011 Standard 1 Element a.

- Choice 1: Demonstrate alignment through courses or transcript analysis using the NSTA Content Analysis Form.
- Choice 2: Demonstrate alignment through coursework as described in the chart below.
- Choice 3: Demonstrate alignment through a preservice preparation program recognition by affiliates. (As of this date, there are no affiliates that offer this option)

If the preparation program:	CHOICE A Content Analysis Form	CHOICE B Coursework
Prepares a teacher to teach courses such as general science at or above the middle school (grades 6-8). This licensure may not teach discipline specific courses (such as biology or chemistry)	<ul style="list-style-type: none"> ✓ Core competencies in the disciplines comprising the composite course (Bio, Chem, Phys, E/Sp). 	<ul style="list-style-type: none"> ✓ One year of introductory coursework in each of the disciplines (Biology, Chemistry, Physics and Earth/Space Science)
Prepares a teacher in a single field (often a major) with or without a supporting second teaching field (a teaching minor). This is a single field program.	<ul style="list-style-type: none"> ✓ Core (Bio, Chem, Phys, or E/Sp) in the primary discipline, and ✓ Advanced competencies in the primary discipline (Bio, Chem, Phys, or E/Sp), ✓ Supporting competencies in the primary discipline (Bio, Chem, Phys, or E/Sp). 	<ul style="list-style-type: none"> ✓ One year of introductory coursework in the area of the Single Field Licensure (Biology, Chemistry, Physics or Earth/Space Science). ✓ Coursework for a major ✓ At least 20 semester hours at the third year or above
Prepares a teacher about equally in two teaching disciplines, usually with less than a major in each. This is a dual field program.	<ul style="list-style-type: none"> ✓ Core in both major disciplines: (Bio, Chem, Phys, E/Sp) and ✓ Advanced competencies in both major disciplines (Bio, Chem, Phys, E/Sp) and ✓ Supporting competencies in both disciplines (Bio, Chem, Phys, E/Sp). 	<ul style="list-style-type: none"> ✓ One year of introductory coursework in each area of the Dual Field Licensure (Biology, Chemistry, Physics or Earth/Space Science). ✓ At least 16 semester hours at the third year or above in each area of the Dual Field
Prepares a teacher at once to teach in three or four disciplines with licensure in each individual discipline. This is a broad field program.	<ul style="list-style-type: none"> ✓ Core competencies (Table A in Bio, Chem, Phys, or E/Sp) in all discipline and ✓ Advanced competencies (Table B Bio, Chem, Phys, or E/Sp) in at least one disciplines and ✓ Supporting competencies in all disciplines (Bio, Chem, Phys, or E/Sp). 	<ul style="list-style-type: none"> ✓ One year of introductory coursework in each area (Biology, Chemistry, Physics and Earth/Space Science). ✓ Coursework for a major in one area ✓ At least 16 semester hours at the third year or above dispersed among the remaining 3 areas (not the major)

For each program, the program level, licensure track, and the nature of preparation are at the top of the page. For example, “Masters secondary single field program in biology with possible minors in chemistry, physics, or earth/space science.” *Report your requirements in the most efficient way.* For example, if all of the teaching minors are the same regardless of the major they are paired with, report them only once.

Your program does not have to be aligned completely with the standards at least initially. An 80% **alignment between the NSTA content standards and program coursework** is expected within each content table.

Instructions for Completing the Forms

For each program, complete the curriculum evaluation as follows:

- If your institution prescribes the coursework in science for each teaching major and minor, as is the case in most undergraduate programs, enter in column B the numbers and titles of the **required** courses that address the subject matter identified in column A. Include advising sheets as a separate attachment.
- If you accept candidates with science coursework taken elsewhere, state the advising requirement using column B that ensures that candidates have studied the subject matter content in column A. Include your advising sheets in the appendix.
- DO NOT provide syllabi. Include brief content descriptions for courses ONLY when the course titles are not reasonably descriptive of the content. (“Ecology” is reasonably descriptive, while “Integrative Science” is not descriptive). Be sure to refer reviewers to the descriptor.
- If a course has a typical science name (such as Analytical Chemistry), but the content in that course is atypical (if there is a significant amount of environmental science in the course), include brief content descriptions.
- Note that the same courses or advising requirements may appear multiple times in these tables.
- If you do not have a requirement that covers a particular topic, simply enter “not covered.” Do not leave the space blank. NOTE: **Science content may be in science courses or in education courses**

Special instructions:

- Secondary Physical Science is usually a composite of two disciplines (chemistry and physics) but sometimes also includes earth/space sciences. General science usually includes all four traditional subject area disciplines, but the teacher does not teach specific content courses.
- Preparation of elementary science specialists or **middle school** science teachers should follow the specific recommendations outlined on the Elementary Science Specialists and Middle Level Science Teachers Content Analysis Form available from the NSTA website: www.nsta.org/preservice.

Content Analysis for Secondary Science

Competency Requirements for All Science Teachers

Science Content Requirement Analysis Tables A, B, and C for Biology

Table A: Biology

A. Core Competencies (numbers 1-12)	B: Required course number & name or advising requirements
Life processes in living systems including organization of matter and energy.	
Similarities and differences among animals, plants, fungi, microorganisms, and viruses	
Ecological systems including the interrelationships and dependencies of organisms with each other and their environments.	
Population dynamics and the impact of population on its environment.	
General concepts of genetics and heredity	
Organizations and functions of cells and multi-cellular systems.	
Behavior of organisms and their relationships to social systems.	

Regulation of biological systems including homeostatic mechanisms	
Fundamental processes of modeling and investigating in the biological sciences	
Applications of biology in environmental quality and in personal and community health	
Bioenergetics including major biochemical pathways	
Molecular genetics and heredity and mechanisms of genetic modification	
Molecular basis for evolutionary theory and classification	

Table B: Biology

B. Advanced Competencies (numbers 13-21)	B: Required course number & name or advising requirements
Biochemical interactions of organisms and their environments	
Causes, characteristics, and avoidance of viral, bacterial, and parasitic diseases	
Molecular genetics	
Issues related to living systems such as genetic modification, uses of biotechnology, cloning, and pollution from farming.	
Historical development and perspectives in biology including contributions of significant figures and underrepresented groups, and the evolution of theories in biology	
How to design, conduct, and report research in biology	

Table C: Biology

C. Supporting Competencies (numbers 22-42)	B: Required course number & name or advising requirements
General chemistry.	
Biochemistry	
Basic chemistry laboratory techniques	
Physics	
Light	
Sound	
Optics	
Electricity	
Energy and order	
Magnetism	
Earth and space sciences	
Energy and geochemical cycles	
Climate	
Oceans	
Weather	
Natural resources	
Changes in the Earth	
Mathematics	
Probability	
Statistics	

Science Content Requirement Analysis Tables A, B, and C for Chemistry

Table A: Chemistry

A. Core Competencies (numbers 1-13)	B: Required course number & name or advising requirements
Fundamental structures of atoms and molecules	
Basic principles of ionic, covalent, and metallic bonding	
Periodicity of physical and chemical properties of elements	
Laws of conservation of matter and energy	
Fundamental of chemical kinetics, equilibrium and thermodynamics	
Kinetic molecular theory and gas laws	
Mole concept, stoichiometry, and laws of composition	
Solutions, colloids, and colligative properties	
Acids/base chemistry	
Fundamental oxidation-reduction chemistry	
Fundamental organic chemistry and biochemistry	
Nature of science: Fundamental processes in chemistry	
Applications of chemistry in personal and community health and environmental quality	
Fundamentals of nuclear chemistry	
Historical development and perspectives in chemistry	

Table B: Chemistry

B. Advanced Competencies (numbers 14-27)	B: Required course number & name or advising requirements
Principles of electrochemistry	
Transition elements and coordination compounds	
Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to properties of matter	
Advanced concepts in chemical kinetics, equilibrium, gas laws, and thermodynamics	
Lewis structures and molecular geometry	
Advanced concepts in acid/base chemistry, including buffers	
Major biological compounds and reactions	
Solvent system concepts	
Chemical reactivity and molecular structure including electronic and steric effects	
Organic chemistry including syntheses, reactions, mechanisms, and aromaticity	
Green chemistry and sustainability	
How to design, conduct, and report research in chemistry	

Table C: Chemistry

C. Supporting Competencies (numbers 28-47)	B: Required course number & name or advising requirements
Biology	
Molecular biology	
Ecology	
Earth science	
Geochemistry	
Cycles of matter	
Energetics of Earth systems	
Physics	

Energy	
Properties and function of waves	
Properties and function of motions	
Properties and function of forces	
Electricity	
Magnetism	
Mathematical and statistical concepts	
Statistics	
Use of differential equations	
Calculus	

Science Content Requirement Analysis Tables A, B, and C for the Earth/Space Sciences

Table A: Earth/Space science

A. Core Competencies (numbers 1-12)	B: Required course number & name or advising requirements
Characteristics of land, atmosphere, and ocean systems on Earth	
Properties, measurement, and classification of Earth materials	
Changes in the Earth including land formation and erosion	
Geochemical cycles including biotic and abiotic systems	
Energy flow and transformation in Earth systems	
Hydrological features of the Earth	
Patterns and changes in the atmosphere, weather, and climate	
Origin, evolution, and planetary behaviors of Earth	
Origin, evolution, and properties of the universe	
Fundamental processes of investigating in the Earth and space sciences	
Sources and limits of natural resources	
Applications of Earth and space sciences to environmental quality and to personal and community health and welfare.	

Table B: Earth/Space Science

B. Advanced Competencies (numbers 13-22)	B: Required course number & name or advising requirements
Gradual and catastrophic changes in the Earth	
Oceans and their relationship to changes in atmosphere and climate.	
Hydrological cycles and problems of distribution and use of water	
Dating of the Earth and other objects in the universe	
Structures and interactions of energy and matter in the universe.	
Impact of changes in the Earth on the evolution and distribution of living things.	
Issues related to changes in Earth Systems such as global climate change, mine subsidence, and channeling of waterways.	
Historical development and perspectives, including contributions of significant figures and underrepresented groups, and the evolution of theories in the Earth and space sciences.	
How to design, conduct, and report research in the Earth and space sciences	

Table C: Earth/Space Science

C. Supporting Competencies (numbers 23-47)	B: Required course number & name or advising requirements
Biology	
Evolution	
Ecology	
Population dynamics	
Flow of energy	
Flow materials through Earth systems	
Chemistry	
Broad concepts of inorganic chemistry	
Basic laboratory techniques of inorganic chemistry	
Broad concepts of organic chemistry	
Basic laboratory techniques of organic chemistry	
Physics including	

Electricity	
Forces and motion	
Energy	
Magnetism	
Thermodynamics	
Optics	
Sound	
Mathematics	
Statistics	
Probability	

Science Content Requirement Analysis Tables A, B, and C for Physics

Table A: Physics

A. Core Competencies (numbers 1-11)	B: Required course number & name or advising requirements
Energy, work, and power	
Motion, major forces, and momentum	
Newtonian physics w/engineering applications	
Conservation mass, momentum, energy, and charge	
Physical properties of matter: solids, liquids, and gases	
Kinetic-molecular motion and atomic models	
Radioactivity, nuclear reactors, fission, and fusion	
Wave theory, sound, light, the electromagnetic spectrum and optics	
Electricity and magnetism	
Fundamental processes of investigating in physics	
Applications of physics in environmental quality and to personal and community health	

Table B: Physics

B. Advanced Competencies (numbers 12-22)	B: Required course number & name or advising requirements
Thermodynamics and energy-matter relationships	
Nuclear physics including matter-energy duality and reactivity	
Angular rotation and momentum, centripetal forces, and vector analysis	
Quantum mechanics, space-time relationships, and special relativity	
Models of nuclear and subatomic structures and behavior	
Light behavior, including wave-particle duality and models	
Electrical phenomena including electric fields, vector analysis, energy, potential, capacitance, and inductance	
Issues related to physics such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development	
Historical development and cosmological perspectives in physics including contributions of significant figures and underrepresented groups, and evolution of theories in physics	
How to design, conduct, and report research in physics	
Applications of physics and engineering in society, business, industry, and health fields.	

Table C: Physics

C. Supporting Competencies (numbers 23-40)	B: Required course number & name or advising requirements
Biology	
Organization of life	
Bioenergetics	
Biomechanics	
Cycles of matter	
Chemistry	
Organization of matter and energy	
Electrochemistry	
Thermodynamics	

Bonding	
Earth sciences and/or astronomy	
Structure of the universe	
Energy	
Interactions of matter	
Mathematical and statistical concepts and skills	
Statistics	
Use of differential equations	
Calculus	

Course descriptions – for courses listed above that are unique or the content is not easily understood by any science education professor. For example, Introductory Biology I and II are similar across institutions in the US. But, Integrated Science is not.