NSTA Science Content Analysis Form: Secondary Science

Instructions for Preparing for Your Review

Tables provided below include, in the left column, the 2012 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 2012 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)	✓ Core competencies in the disciplines comprising the composite course (Bio,Chem, Phys, E/Sp).	✓ 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.	✓ 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).	✓ 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.	✓ 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).	✓ 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.	✓ 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).	✓ 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

If the preparation program:	CHOICE A **Content Analysis Form**	CHOICE B **Coursework**
		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. A 90% **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 (Biology A1 - A13)	**Required course number & name or advising requirements**
A1. Life processes in living systems including organization of matter and energy.	
A2. Similarities and differences among animals, plants, fungi, microorganisms, and viruses	
A3. Ecological systems including the interrelationships and dependencies of organisms with each other and their environments.	
A4. Population dynamics and the impact of population on its environment.	
A5. General concepts of genetics and heredity	
A6. Organizations and functions of cells and multi-cellular systems.	
A7. Behavior of organisms and their relationships to social systems.	
A8. Regulation of biological systems including homeostatic mechanisms	
A9. Fundamental processes of modeling and investigating in the biological sciences	
A10. Applications of biology in environmental quality and in personal and community health	
A11. Bioenergetics including major biochemical pathways	
A12. Molecular genetics and heredity and mechanisms of genetic modification	
A13. Molecular basis for evolutionary theory and classification	

Table B: Biology

B. Advanced Competencies (Biology B1 – B6)	**Required course number & name or advising requirements**
B1. Biochemical interactions of organisms and their environments	
B2. Causes, characteristics, and avoidance of viral, bacterial, and parasitic diseases	
B3. Molecular genetics	
B4. Issues related to living systems such as genetic modification, uses of biotechnology, cloning, and pollution from farming.	
B5. Historical development and perspectives in biology including contributions of significant figures and underrepresented groups, and the evolution of theories in biology	
B6. How to design, conduct, and report research in biology	

Table C: Biology

C. Supporting Competencies (Biology C1 – C17)	**Required course number & name or advising requirements**
Chemistry	
C1. General chemistry	
C2. Biochemistry	

C3. Basic chemistry laboratory techniques	
Physics	
C4. Light	
C5. Sound	
C6. Optics	
C7. Electricity	
C8. Energy and order	
C9. Magnetism	
Earth and space sciences	
C10. Energy and geochemical cycles	
C11. Climate	
C12. Oceans	
C13. Weather	
C14. Natural resources	
C15. Changes in the Earth	
Mathematics	
C16. Probability	
C17. Statistics	

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

Table A: Chemistry

A. Core Competencies (Chemistry A1 – A15)	**Required course number & name or advising requirements**
A1. Fundamental structures of atoms and molecules	
A2. Basic principles of ionic, covalent, and metallic bonding	
A3. Periodicity of physical and chemical properties of elements	
A4. Laws of conservation of matter and energy	
A5. Fundamental of chemical kinetics, equilibrium and thermodynamics	
A6. Kinetic molecular theory and gas laws	
A7. Mole concept, stoichiometry, and laws of composition	
A8. Solutions, colloids, and colligative properties	
A9. Acids/base chemistry	
A10. Fundamental oxidation-reduction chemistry	
A11. Fundamental organic chemistry and biochemistry	
A12. Nature of science: Fundamental processes in chemistry	
A13. Applications of chemistry in personal and community health and environmental quality	
A14. Fundamentals of nuclear chemistry	
A15. Historical development and perspectives in chemistry	

Table B: Chemistry

B. Advanced Competencies (Chemistry B1 – B12)	**Required course number & name or advising requirements**
B1. Principles of electrochemistry	
B2. Transition elements and coordination compounds	
B3. Molecular orbital theory, aromaticity, metallic and ionic structures, and correlation to properties of matter	
B4. Advanced concepts in chemical kinetics, equilibrium, gas laws, and thermodynamics	
B5. Lewis structures and molecular geometry	
B6. Advanced concepts in acid/base chemistry, including buffers	
B7. Major biological compounds and reactions	
B8. Solvent system concepts	
B9. Chemical reactivity and molecular structure including electronic and steric effects	
B10. Organic chemistry including syntheses, reactions, mechanisms, and aromaticity	
B11. Green chemistry and sustainability	
B12. How to design, conduct, and report research in chemistry	

Table C: Chemistry

C. Supporting Competencies (Chemistry C1 – C14)	**Required course number & name or advising requirements**
Biology	
C1. Molecular biology	
C2. Ecology	
Earth science	
C3. Geochemistry	
C4. Cycles of matter	
C5. Energetics of Earth systems	
Physics	

C6. Energy	
C7. Properties and function of waves	
C8. Properties and function of motions	
C9. Properties and function of forces	
C10. Electricity	
C11. Magnetism	
Mathematical and statistical concepts	
C12. Statistics	
C13. Use of differential equations	
C14. Calculus	

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

A. Core Competencies (Earth/Space Science A1 – A12)	**Required course number & name or advising requirements**
A1. Characteristics of land, atmosphere, and ocean systems on Earth	
A2. Properties, measurement, and classification of Earth materials	
A3. Changes in the Earth including land formation and erosion	
A4. Geochemical cycles including biotic and abiotic systems	
A5. Energy flow and transformation in Earth systems	
A6. Hydrological features of the Earth	
A7. Patterns and changes in the atmosphere, weather, and climate	
A8. Origin, evolution, and planetary behaviors of Earth	
A9. Origin, evolution, and properties of the universe	
A10. Fundamental processes of investigating in the Earth and space sciences	
A11. Sources and limits of natural resources	
A12. 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 (Earth/Space Science B1 – B9)	**Required course number & name or advising requirements**
B1. Gradual and catastrophic changes in the Earth	
B2. Oceans and their relationship to changes in atmosphere and climate.	
B3. Hydrological cycles and problems of distribution and use of water	
B4. Dating of the Earth and other objects in the universe	
B5. Structures and interactions of energy and matter in the universe.	
B6. Impact of changes in the Earth on the evolution and distribution of living things.	
B7. Issues related to changes in Earth Systems such as global climate change, mine subsidence, and channeling of waterways.	
B8. Historical development and perspectives, including contributions of significant figures and underrepresented groups, and the evolution of theories in the Earth and space sciences.	
B9. How to design, conduct, and report research in the Earth and space sciences	

Table C: Earth/Space Science

C. Supporting Competencies (Earth/Space Science C1 – C18)	**Required course number & name or advising requirements**
Biology	
C1. Evolution	
C2. Ecology	
C3. Population dynamics	
C4. Flow of energy	
C5. Flow materials through Earth systems	
Chemistry	
C6. Broad concepts of inorganic chemistry	
C7. Basic laboratory techniques of inorganic chemistry	

C8. Broad concepts of organic chemistry	
C9. Basic laboratory techniques of organic chemistry	
Physics including	
C10. Electricity	
C11. Forces and motion	
C12. Energy	
C13. Magnetism	
C14. Thermodynamics	
C15. Optics	
C16. Sound	
Mathematics	
C17. Statistics	
C18. Probability	

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

Table A: Physics

A. Core Competencies (Physics 1A - A11)	**Required course number & name or advising requirements**
A1. Energy, work, and power	
A2. Motion, major forces, and momentum	
A3. Newtonian physics w/engineering applications	
A4. Conservation mass, momentum, energy, and charge	
A5. Physical properties of matter: solids, liquids, and gases	
A6. Kinetic-molecular motion and atomic models	
A7. Radioactivity, nuclear reactors, fission, and fusion	
A8. Wave theory, sound, light, the electromagnetic spectrum and optics	
A9. Electricity and magnetism	
A10. Fundamental processes of investigating in physics	
A11. Applications of physics in environmental quality and to personal and community health	

Table B: Physics

B. Advanced Competencies (Physics B1 – B11)	**B: Required course number & name or advising requirements**
B1. Thermodynamics and energy-matter relationships	
B2. Nuclear physics including matter-energy duality and reactivity	
B3. Angular rotation and momentum, centripetal forces, and vector analysis	
B4. Quantum mechanics, space-time relationships, and special relativity	
B5. Models of nuclear and subatomic structures and behavior	
B6. Light behavior, including wave-particle duality and models	
B7. Electrical phenomena including electric fields, vector analysis, energy, potential, capacitance, and inductance	
B8. Issues related to physics such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development	
B9. Historical development and cosmological perspectives in physics including contributions of significant figures and underrepresented groups, and evolution of theories in physics	
B10. How to design, conduct, and report research in physics	
B11. Applications of physics and engineering in society, business, industry, and health fields.	

Table C: Physics

C. Supporting Competencies (Physics C1 – C14)	**B: Required course number & name or advising requirements**
Biology	
C1. Organization of life	
C2. Bioenergetics	
C3. Biomechanics	
C4. Cycles of matter	
Chemistry	
C5. Organization of matter and energy	
C6. Electrochemistry	
C7. Thermodynamics	

C8. Bonding	
Earth sciences and/or astronomy	
C9. Structure of the universe	
C10. Energy	
C11. Interactions of matter	
Mathematical and statistical concepts and skills	
C12. Statistics	
C13. Use of differential equations	
C14. 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.