Science teachers will major in one of the following:
   A. A major in a single science, i.e., biology, chemistry, physics, or earth science (geology).
   B. An interdisciplinary major in science that includes the equivalent of a minor in two of the four disciplines.
   C. A cross-disciplinary major including a science and another appropriate, related discipline, such as physics and math.
   D. A cross-disciplinary major including study in STEM (science, technology, engineering, mathematics) areas.

**CONTENT MAJOR**
Select content major:
   ___ A. Single Science ________________________________
   ___ B. Interdisciplinary Major in Science ________________________
   ___ C. Cross-disciplinary Major in Science ________________________
   ___ D. Cross-disciplinary Major in STEM area ________________________

**CONCENTRATION AREA(S)**
Identify areas of concentration with numbers of credits:
*(A concentration is an area of study with at least 12 credit hours)*

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**Science Core Standards**

*Content Knowledge and Skills; Science Pedagogy; Inquiry, Technology and Engineering; and Science Learning Environment are all addressed by a) completion of an acceptable STEM major (see above), and b) elements built into the Peabody MEd/Licensure program.*

**Biology Content Standards**

Biology teacher candidates demonstrate a readiness for leading students to understand:
*(On the line for each item, provide evidence of meeting the knowledge and skills stated.)*

**Standard 1: Overarching Principles and Concepts**

   B 1.1 The central role that the theory of evolution plays in understanding and interpreting the core biology concepts
   B 1.2 Fundamental aspects of biological investigation including accessing the biology literature
   B 1.3 How to design, conduct, and report the findings of biological research

**MED B 1.4 Historical development, language, and patterns of reasoning in biology including contributions of significant individuals and underrepresented groups, and the synergistic interactions between biology and other scientific disciplines**

**Standard 2: Living Systems**

   B 2.1 Characteristics of life
   B 2.2 Biological organization
   B 2.3 Flow of matter and energy among living things

**Standard 3: Cells**

   B 3.1 Structure and function of the cell
   B 3.2 Biological membranes
   B 3.3 Mitosis and meiosis
   B 3.4 Biochemical and interactions and pathways in cells and cell systems
   B 3.5 Energy-releasing and storage pathways
B 3.6 Energy transfer in redox-reactions

**Standard 4: Genetics, Biotechnology, and Bioengineering**

- B 4.1 Chromosomes, DNA, genes
- B 4.2 Basic principles of heredity
- B 4.3 Gene expression and regulation
- B 4.4 DNA and enabling technologies
- B 4.5 Human genome
- B 4.6 Genetic change
- B 4.7 Applications of biotechnology in society

**Standard 5: Biodiversity**

- B 5.1 Similarities and differences among the structures and functions of animals, plants, fungi, protists, bacteria, and viruses
- B 5.2 Behavioral interactions between organisms and their environments
- B 5.3 Regulation within biological systems including homeostatic mechanisms
- B 5.4 Factors associated with the causes and transmission of disease
- B 5.5 Biodiversity issues

**Standard 6: Biological Classification**

- B 6.1 Taxonomic categories
- B 6.2 Binomial nomenclature
- B 6.3 Principles of systematics
- B 6.4 Scientific basis for classification

**Standard 7: Evolution**

- B 7.1 Organic evolution
- B 7.2 Evidence of evolution
- B 7.3 Specification and macroevolution
- B 7.4 Origin of major groups of organisms
- B 7.5 Molecular basis of modern evolutionary theory

**Standard 8: Ecological Systems**

- B 8.1 Interactions between organisms and their environment
- B 8.2 Nutritional relationships in nature
- B 8.3 Population dynamics and the impact of population size on the environment
- B 8.4 Causes of environmental degradation and its impact on the environment

**Standard 9: Synergistic Scientific Fields and Mathematics**

- B 9.1 Chemistry, including the chemical basis of life, organic compounds, and proper laboratory techniques
- B 9.2 Physics, including light, sound, optics, electricity, energy and order, magnetism, and thermodynamics
- B 9.3 Earth and Space Science, including energy and geochemical cycles, weather and climate, oceans, changes in the Earth, and natural resources
- B 9.4 Mathematics, including skills for solving problems, and the rules of probability and statistics

**COMMENTS:**

**DEFICIENCIES:**

**ADVISOR APPROVAL:**

_______________________________________________________________

(Date)
CHEMISTRY (Grades 7-12) ENDORSEMENT
(The teaching of general science in grades 7 and 8 is included in the endorsement.)

Science teachers will major in one of the following:
A. A major in a single science, i.e., biology, chemistry, physics, or earth science (geology).
B. An interdisciplinary major in science that includes the equivalent of a minor in two of the four disciplines.
C. A cross-disciplinary major including a science and another appropriate, related discipline, such as physics and math.
D. A cross-disciplinary major including study in STEM (science, technology, engineering, mathematics) areas.

CONTENT MAJOR
Select content major:
   ___ A. Single Science ____________________________
   ___ B. Interdisciplinary Major in Science _______________________
   ___ C. Cross-disciplinary Major in Science ____________________________________
   ___ D. Cross-disciplinary Major in STEM area ________________________________

CONCENTRATION AREA(S)
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Science Core Standards

Content Knowledge and Skills; Science Pedagogy; Inquiry, Technology and Engineering; and Science Learning Environment are all addressed by a) completion of an acceptable STEM major (see above), and b) elements built into the Peabody MEd/Licensure program.

Chemistry Content Standards

Chemistry teacher candidates demonstrate a readiness for leading students to understand:
(On the line for each item, provide evidence of meeting the knowledge and skills stated.)

Standard 1: Overarching Principles and Concepts
   ___ C 1.1 The central role that the theory of conservation of mass, energy, and electrical charge play in understanding core chemistry concepts
   ___ C 1.2 Fundamental processes of investigating chemistry including accessing chemistry literature
   ___ C 1.3 How to design, conduct, and report the findings of chemical research
   **MED C 1.4 Historical development, language, and patterns of reasoning in chemistry including contributions of significant individuals and underrepresented groups, and the synergistic interactions between chemistry and other scientific disciplines

Standard 2: Applications
   ___ C 2.1 Applications of chemistry to understanding the processes of living systems
   ___ C 2.2 Applications of chemistry to material science including polymers and composites
   ___ C 2.3 Applications of chemistry to environmental quality, sustainability, and emerging disciplines such as nanoscience and green chemistry
   ___ C 2.4 Applications of chemistry to the industrial enterprise
   ___ C 2.5 Applications of chemistry to issues of global concern such as energy, food and fiber production, healthcare, and electronic communication
Standard 3: Atomic Structure and Periodicity

- 3.1 Experimental evidence associated with the evolution of historical models of the atom
- 3.2 Fundamental structure of atoms and molecules
- 3.3 Physical and chemical properties and classification of elements including periodicity
- 3.4 Trends in the periodic table of the elements
- 3.5 Isotopes, radioactivity, and nuclear reactions

Standard 4: States of Matter

- 4.1 Properties and behaviors of solids, liquids, gases, and plasmas
- 4.2 Intermolecular forces between chemical species
- 4.3 Kinetic molecular theory and its relationship to the behavior of gases

Standard 5: Interactions of Matter

- 5.1 Basic principles of ionic, covalent, and metallic bonding
- 5.2 Laws of definite composition and multiple proportion
- 5.3 How to write chemical formulas and equations involving ions, polyatomic ions, and molecules
- 5.4 Chemical nomenclature
- 5.5 Types of chemical reactions
- 5.6 Mole concept and stoichiometry

Standard 6: Energy

- 6.1 Energy flow through chemical systems
- 6.2 State functions (internal energy and enthalpy) and the heat and work done in a chemical reaction
- 6.3 Energy associated with bond formation, Hess's Law, heats of formation, heats of reaction, and calorimetry
- 6.4 Entropy, Gibbs free energy, and spontaneity of reactions

Standard 7: Chemical Reactions

- 7.1 Electrolytes, non-electrolytes, expressions of solution concentration, and colligative properties
- 7.2 Acids, bases, salts and their reactions including neutralization and titrametric analysis
- 7.3 Oxidation-reduction reactions, the activity series, and electrochemistry
- 7.4 Kinetics of chemical reactions and factors affecting chemical reaction rate laws
- 7.5 How to utilize solubility laws and reactants to predict the product of a reaction
- 7.6 Equilibrium phenomena, their associated thermodynamics, and related calculations

Standard 8: Molecular Shapes and Geometries

- 8.1 How to write correct Lewis structures, including resonance structures and hybrids
- 8.2 How to assign formal charges to elements in a Lewis structure
- 8.3 Valence Shell Electron Pair Repulsion theory to predict the shape of chemical species
- 8.4 Molecular orbital theory and hybridization to rationalize the shape and role of chemical species and their chemical and physical properties

Standard 9: Synergistic Scientific Fields and Mathematics

- 9.1 Biology, including the chemical basis of life, organic compounds, and proper laboratory techniques
- 9.2 Physics, including light, sound, optics, electricity, energy and order, magnetism, and thermodynamics
- 9.3 Earth and Space Science, including energy and geochemical cycles, weather and climate, oceans, changes in the Earth, and natural resources
- 9.4 Mathematics, including skills for solving problems, and the rules of probability and statistics
- 9.5 Algebraic, geometric and trigonometric methods to solve chemical problems
- 9.6 Integral and differential calculus to solve chemical problems

COMMENTS:

DEFICIENCIES:

ADVISOR APPROVAL: ______________________________ (Date)
Physics (Grades 7-12) Endorsement
(The teaching of general science in grades 7 and 8 is included in the endorsement.)

Science teachers will major in one of the following:
A. A major in a single science, i.e., biology, chemistry, physics, or earth science (geology).
B. An interdisciplinary major in science that includes the equivalent of a minor in two of the four disciplines.
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Content Major
Select content major:
_____ A. Single Science __________________________
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Science Core Standards

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Physics Content Standards

Physics teacher candidates demonstrate a readiness for leading students to understand:
(On the line for each item, provide evidence of meeting the knowledge and skills stated.)

Standard 1: Overarching Principles and Concepts
_____ P 1.1 The central role that the theory of conservation of mass, momentum, energy, and charge play in understanding core physics concepts
_____ P 1.2 Fundamental processes of investigating physics including accessing physics literature
_____ P 1.3 How to design, conduct, and report the findings of physics research
**MED** P 1.4 Historical development, cosmological perspectives in physics the evolution of major physics theories, and the synergistic interactions between physics and other scientific disciplines

Standard 2: Applications
_____ P 2.1 Applications of physics in environmental quality and to personal and community health
_____ P 2.2 Applications of physics and engineering in society, business, industry and health fields
_____ P 2.3 Applications of physics to issues of global concern such as disposal of nuclear waste, light pollution, shielding communication systems and weapons development

Standard 3: Mechanics
_____ P 3.1 Mechanical kinetic and potential energy, work, and power
_____ P 3.2 Motion, forces and momentum
_____ P 3.3 Newtonian principles and laws including engineering applications
_____ P 3.4 Angular rotation and momentum, centripetal forces, and vector analysis
Standard 4: Thermodynamics
- P 4.1 Physical properties of matter
- P 4.2 Kinetic-molecular motion and atomic models
- P 4.3 Thermodynamics and relationships between energy and matter

Standard 5: Waves, Sound and Optics
- P 5.1 Principles of geometric optics
- P 5.2 Wave theory, sound, light and the electromagnetic spectrum
- P 5.3 Description of light as a wave, including explaining the electromagnetic spectrum, the limits of human vision, the importance of non-visible radiation, interference, diffraction, polarization
- P 5.4 Quantum behavior of electromagnetic radiation including the photoelectric effect and lasers

Standard 6: Electricity and Magnetism
- P 6.1 Electrical phenomena including electric fields, energy, electric potential and capacitance
- P 6.2 Magnetism phenomena including magnetic fields, magnetic potential and inductance
- P 6.3 Simple electrical circuits, especially related to household power usage and safety

Standard 7: Modern, Nuclear and Particle Physics
- P 7.1 Nuclear reactors, fission, fusion and effects of ionizing radiation
- P 7.2 Nuclear physics including matter-energy duality and reactivity
- P 7.3 Quantum mechanics, space-time relationships and special relativity
- P 7.4 Models of nuclear and subatomic structures and behavior
- P 7.5 Light behavior including wave-particle duality and models

Standard 8: Synergistic Scientific Fields and Mathematics
- P 8.1 Biology, including the chemical basis of life, organic compounds and proper laboratory techniques
- P 8.2 Chemistry, including the chemical basis of life, organic compounds and proper laboratory techniques
- P 8.3 Earth and Space Science, including energy and geochemical cycles, weather and climate, oceans, changes in the Earth, and natural resources
- P 8.4 Mathematics, including skills for solving problems, and the rules of probability and statistics
- P 8.5 Vector analysis up through the use of vector calculus to solve physics problems

COMMENTS:

DEFICIENCIES:

ADVISOR APPROVAL:

_________________________________________________________ (Date)
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Science Core Standards

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Earth Science Content Standards

Earth science teacher candidates demonstrate a readiness for leading students to understand:
(On the line for each item, provide evidence of meeting the knowledge and skills stated.)

Standard 1: Overarching Principles and Concepts

______ ES 1.1 The central role that the principles of tectonics, evolution, energy, and the cycling of materials play in understanding core earth science concepts.
______ ES 1.2 Fundamental processes of investigating earth science including accessing earth science literature
______ ES 1.3 How to design, conduct, and report the findings of earth science research
MEd ES 1.4 Historical development and cosmological perspectives in earth science including contributions of significant figures and underrepresented groups, the evolution of major earth science theories, and the synergistic interactions between earth science and other scientific disciplines

Standard 2: Earth Materials

______ ES 2.1 Classification and identification of minerals and rocks
______ ES 2.2 Origin and natural history of igneous, metamorphic, and sedimentary rocks
______ ES 2.3 Energy flow within Earth systems
______ ES 2.4 Environmental issues associated with the use of energy, mineral, and rock resources
Standard 3: Earth as a Dynamic System

ES 3.1 Interactive systems including hydrosphere, lithosphere, biosphere, cryosphere, atmosphere, and space
ES 3.2 Interrelationships among the hydrologic, geochemical, rock, and tectonic cycles
ES 3.3 Tectonic events and processes
ES 3.4 Geologic processes responsible for major landforms on the surface and sea floor
ES 3.5 Landforms produced by deformation, weathering, and erosion
ES 3.6 Surface and groundwater movement
ES 3.7 Issues related to surface and groundwater movement
ES 3.8 Extreme geologic events such as volcanoes, earthquakes, and tsunamis

Standard 4: Earth's History

ES 4.1 Evolutionary change that encompasses living things (organic evolution), Earth’s physical environment (geologic evolution), Earth’s place in the Universe (cosmic evolution), and within human societies (cultural evolution)
ES 4.2 Role of living things in Earth systems and environmental change
ES 4.3 Landscape evolution over geologic time
ES 4.4 Impact of changes in the Earth on the evolution and distribution of living things
ES 4.5 Fossil evidence to reconstruct ancient environments and climates
ES 4.6 Geologic dating methods

Standard 5: Weather and Climate

ES 5.1 Weather components and processes
ES 5.2 Severe weather phenomena such as tornadoes, hurricanes and flooding
ES 5.3 Humans as instruments of global change
ES 5.4 Climate change issues facing society

Standard 6: Universe

ES 6.1 Leading hypotheses and theories to explain the origin and evolution of galaxies, planets, satellites, and the solar system
ES 6.2 Structure, composition, and dynamics of stars, planets, and satellites

Standard 7: Synergistic Scientific Fields and Mathematics

ES 7.1 Biology, including the chemical basis of life, organic compounds, and proper laboratory techniques
ES 7.2 Chemistry, including the chemical basis of life, organic compounds, and proper laboratory techniques
ES 7.3 Physics, including light, sound, optics, electricity, energy and order, magnetism, and thermodynamics
ES 7.4 Mathematics, including skills for solving problems, and the rules of probability and statistics

COMMENTS:

DEFICIENCIES:

ADVISOR APPROVAL:

________________________ (Date)