Rule 24 Matrix
Table of Alignment of Standards and Assessments

Revised Program X revised 2017

Name of Institution: Peru State College
Date Submitted: May 8, 2017

Endorsement: **SCIENCE**
Total Hours Required by Rule 24: **48**
Program Hours Required by Institution: 49
Grade Levels: **7-12**
Endorsement Type: **FIELD**

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a minimum of two laboratory-based course in each of the four disciplines in the sciences (biology, chemistry, Earth and space science, and physics). A laboratory-based course provides activity-based, hands-on experience for all students. Laboratory activities shall 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.																																								
S1. Content Knowledge – Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and application in their fields of licensure. Candidates will:																																								
E1. Understand the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**																												

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E2. Understand the central concepts of the supporting disciplines as outlined in the content analysis form.		x	x	x		x	x		x	x	x	x	x																									
E3. Show an understanding of state and national curriculum standards and their impact on the content knowledge necessary for teaching P-12 students.		x	x	x		x	x		x	x	x	x	x																									
E4. All teachers of **biology** should be prepared to lead students to understand the unifying concepts required of all teachers of science, and should also be prepared to lead students to understand the following:																																						
A. Life processes in living systems including organization of matter and energy;		x	x		x		x																															
B. Similarities and differences among animals, plants, fungi, microorganisms, and viruses;		x	x																																			
C. Ecological systems including the interrelationships and dependencies of organisms with each other and their environments;					x																																	
D. Population dynamics and the impact of population on its environment;					x																																	
E. General concepts of genetics and heredity;						x																																
F. Organizations and functions of cells and multi-cellular systems;		x	x	x		x																																

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G. Behavior of organisms and their relationships to social systems;					X																																				
H. Regulation of biological systems including homeostatic mechanisms;					X																																				
I. Fundamental processes of modeling and investigating in the biological sciences;					X																																				
J. Applications of biology in environmental quality and in personal and community health;		X		X	X						X	X																													
K. Bioenergetics including biochemical pathways;	X	X	X	X	X																																				
L. Molecular genetics and heredity and mechanisms of genetic modification;					X																																				
M. Molecular basis for evolutionary theory and classification; and			X		X																																				
E5. All teachers of **chemistry** will be prepared to lead students to understand the unifying concepts required of all teachers of science, and will also be prepared to lead students to understand the following:																																									
A. Fundamental structures of atoms and molecules;							X																																		
B. Basic principles of ionic, covalent, and metallic bonding;							X																																		
C. Periodicity of physical and chemical properties of elements;						X																																			
D. Laws of conservation of matter and energy;						X	X																																		

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E. Fundamentals of chemical kinetics, equilibrium, and thermodynamics;								x																																
F. Kinetic molecular theory and gas laws;								x																																
G. Mole concept, stoichiometry, and laws of composition;							x																																	
H. Solutions, colloids, and colligative properties;								x																																
I. Acids/base chemistry;								x																																
J. Fundamental oxidation-reduction chemistry, fundamental organic chemistry and biochemistry;								x	x																															
K. Fundamental biochemistry;						x			x																															
L. Nature of Science and fundamental processes in chemistry;							x	x																																
M. Applications of chemistry in personal and community health and environmental quality;							x	x	x																															
N. Fundamentals of nuclear chemistry; and								x																																
O. Historical development and perspectives in chemistry.								x																																
E6. All teachers of **Earth and space science** will be prepared to lead students to understand the unifying concepts required of all teachers of science, and will also be prepared to lead students to understand the following:																																								

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A. Characteristics of land, atmosphere, and ocean systems on Earth;		x	x		x							x	x																									
B. Properties, measurement, and classification of Earth materials;							x	x				x	x																									
C. Changes in Earth including land formation and erosion;		x		x	x							x	x																									
D. Geochemical cycles including biotic and abiotic systems;		x	x		x							x	x																									
E. Energy flow and transformation in Earth systems;		x			x							x	x																									
F. Hydrological features of Earth;		x			x							x	x																									
G. Patterns and changes in the atmosphere, weather, and climate;		x	x		x							x	x																									
H. Origin, evolution, and planetary behaviors of Earth;		x	x	x	x							x	x																									
I. Origin, evolution, and properties of the universe;												x	x																									
J. Fundamental processes of investigating in Earth and space science;		x	x				x	x				x	x																									
K. Sources and limits of natural resources; and		x	x				x	x				x	x																									
L. Applications of Earth and space sciences to environmental quality and to personal and community health and welfare.		x	x				x	x				x	x																									
E7. All teachers of **physics** will be prepared to lead students to understand the unifying concepts																																						

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required of all teachers of science, and will also be prepared to lead students to understand:																																								
A. Energy, work, and power;										X																														
B. Motion, major forces, and momentum;										X																														
C. Newtonian principles and laws including engineering applications;										X																														
D. Conservation of mass, momentum, energy, and charge;										X																														
E. Physical properties of matter;						X	X		X																														
F. Kinetic-molecular motion and atomic models;									X	X																														
G. Radioactivity, nuclear reactors, fission, and fusion;						X	X		X	X																														
H. Wave theory, sound, light, the electromagnetic spectrum and optics;										X																														
I. Electricity and magnetism;										X																														
J. Fundamental processes of investigating in physics; and											X	X																												
K. Applications of physics in environmental quality and to personal and community health.											X	X																												
E8. All secondary teachers will also be prepared to lead students to understand the unifying concepts of science, including:																																								

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A. Multiple ways to organize perceptions of the world and how systems organize the studies and knowledge of science;		x	x	x	x	x	x	x	x	x	x	x	x																										
B. Nature of scientific evidence and the use of models for explanation;		x	x	x	x	x	x	x	x	x	x	x	x																										
C. Measurement as a way of knowing and organizing observations of constancy and change;		x	x	x	x	x	x	x	x	x	x	x	x																										
D. Evolution of natural systems and factors that result in evolution or equilibrium; and		x	x	x	x	x	x	x	x	x	x	x	x																										
E. Interrelationships of form, function, and behaviors in living and nonliving systems.		x	x	x	x	x	x	x	x	x	x	x	x																										
F. How to design, conduct, and report research in science.		x	x	x	x	x	x	x	x	x	x	x	x																										
S2. Content Pedagogy – Effective teachers of science understand how students learn and develop scientific knowledge. Candidates use scientific inquiry to develop this knowledge. Candidates will:																																						
E1. Plan multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how students learn science.																x	x			x	x																		
E2. Include active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences.																x	x			x	x																		

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E3. Design instruction and assessment strategies that confront and address naïve concepts/preconceptions.																X	X			X	X																			
S3. Learning Environments – Effective teachers of science are able to plan for engaging students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources--including technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met. Candidates will:																																							
E1. Use a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings - to help all students learn.															X	X	X	X		X	X																			
E2. Plans include active inquiry lessons where students collect and interpret data in order to develop concepts, understand scientific processes, relationships and natural patterns from empirical experiences.																X	X			X	X																			
E3. Plan fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are																X	X		X	X	X																			

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designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated.																																								
E4. Plan a learning environment and learning experiences for all students that demonstrate chemical safety, safety procedures, and the ethical treatment of living organisms within their licensure area.															X					X																				
S4. Safety – Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure. Candidates will:																																								
E1. Design activities in a P-12 classroom that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within their subject area science instruction.																X	X			X	X																			
E2. Design and demonstrate activities in a P-12 classroom that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Candidates ensure safe science activities appropriate for the abilities of all students.																X	X			X	X																			

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E3. Design and demonstrate activities in a P-12 classroom that demonstrate 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.																X	X			X	X																	
S5. Impact on Student Learning – Effective teachers of science provide evidence to show that P-12 students' understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates will:																																						
E1. Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of a change in mental functioning demonstrating that scientific knowledge is gained and/or corrected.																				X	X																	
E2. Provide data to show that P-12 students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertion made in the name of science.																				X	X																	
E3. Engage students in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.																				X	X																	

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S6. Professional Knowledge and Skills – Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content and science pedagogy. They identify with and conduct themselves as part of the science education community. Candidates will:																																						
E1. Engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, or projects within their community.					X	X						X																										
E2. Engage in professional development opportunities such as conferences, research opportunities, or projects within their community.					X	X						X																										