

Higher Education Teacher Preparation Standards

Earth and Space Science grades 6-12



Kansas leads the world in the success of each student.

EARTH AND SPACE SCIENCE

Early Adolescence through Late Adolescence

Grades 6-12, adopted November 9, 2016

“**Learner(s)**” is defined as children including those with disabilities or exceptionalities, who are gifted, and students who represent diversity based on ethnicity, race, socioeconomic status, gender, language, religion, and geographic origin.

Standard 1: Content Pedagogy

Effective science teachers understand how students learn and develop science concepts and practices. They incorporate disciplinary core ideas, scientific and engineering practices, and crosscutting concepts into instruction.

Function 1: Teacher plans multiple lessons using a variety of inquiry approaches incorporating science and engineering practices.

Content Knowledge

1.1.1 CK Knows how to locate resources, design and conduct inquiry-based open-ended science investigations, interpret findings, communicate results, and make judgments based on evidence.

Professional Skills

1.1.2 PS Supports student learning through appropriate curricular and instructional experiences linked to the standards.

1.1.3 PS The teacher is able to develop lessons for students that demonstrate knowledge of the practices of science and engineering by questioning, defining problems, modeling, investigating, and analyzing evidence in order to construct explanations and alternative explanations.

1.1.4 PS The teacher is able to develop lessons in which students collect and interpret data, develop and communicate concepts, and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.

Function 2: Teacher demonstrates knowledge and understanding of how diverse students learn science.

Content Knowledge

1.2.1 CK Knows learning is influenced by cultural and environmental differences of the student and family.

1.2.2 CK Understands developmentally and chronologically age-appropriate needs and practices of students.

1.2.3 CK Understands diverse learning styles.

Professional Skills

1.2.4 PS Gains and values information about the family's culture and environment and uses it to understand individual development and learning.

1.2.5 PS Promotes developmentally and chronologically age-appropriate educational experiences to meet the learning abilities, strengths, needs, and preferences of students.

Function 3: The teacher designs instruction and assessment strategies that confront and address naïve concepts/preconceptions.

Content Knowledge

1.3.1 CK The teacher knows learning is influenced by cultural and environmental differences of the student and family.

1.3.2 CK The teacher understands formative and summative assessment and how they are used.

Professional Skills

1.3.3 PS The teacher uses appropriate formal and informal evaluation/assessment instruments to identify learning needs of students.

1.3.4 PS The teacher is able to identify common student misconceptions and naïve understandings and design and implement appropriate instruction to address these.

Standard 2: Learning Environments

Teachers work with students and others to create and manage environments that support learning.

Function 1: The teacher supports individual and group learning.

Content Knowledge

2.1.1 CK The teacher understands the importance of rigor, respect, and responsibility for the learning environment.

2.1.2 CK The teacher understands how teacher feedback influences student learning.

Professional Skills

2.1.3 PS The teacher sets and articulates appropriate goals that are consistent with knowledge of how students learn science.

2.1.4 PS The teacher sets goals that are aligned with state and other professional standards.

2.1.5 PS The teacher manages the environment to make learning experiences appropriately challenging.

Function 2: The teacher encourages positive social interaction.

Content Knowledge

2.2.1 CK The teacher understands how learner diversity can affect communication and knows how to communicate effectively in differing environments.

2.2.2 CK The teacher understands how learning occurs, how learners construct knowledge, acquire skills, and develop disciplined thinking processes and knows how to use instructional strategies that promote student learning.

Professional Skill

2.2.3a PS The teacher plans fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met.

2.2.3b PS The teacher promotes celebration of learning by providing positive reinforcement and encouraging learners to present work demonstrating their learning and interacting with community members about their work.

2.2.3c PS The teacher communicates verbally and nonverbally, with families, communities, colleagues, and other professionals, in ways that demonstrate respect for and responsiveness to the cultural backgrounds and differing perspectives learners bring to the learning environment.

2.2.3d PS The teacher knows how to help learners work productively and cooperatively with each other to achieve learning goals.

2.2.4a PS The teacher develops plans that reflect the nature and social context of science and inquiry.

- 2.2.4b PS The teacher creates developmentally appropriate instruction that takes into account individual learners' strengths, interests, and needs and that enables each learner to advance and accelerate his/her learning.

Function 3: The teacher promotes active engagement in learning and self-motivation.

Content Knowledge

- 2.3.1 CK The teacher understands the relationships between motivation, engagement, and self-efficacy, and knows how to design learning experiences using strategies that build learner self-direction and ownership of learning.
- 2.3.2 CK The teacher creates learning environments where students have an opportunity to actively engage in the practices of science and engineering.

Professional Skill

- 2.3.3a PS The teacher shows the ability to 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 and applicable instruments and technology.
- 2.3.3b PS The teacher incorporates differentiated instruction strategies to engage students with diverse learning needs.
- 2.3.3c PS The teacher incorporates tools of language development into planning and instruction, including strategies for making content accessible to English language learners and for evaluating and supporting their development of English proficiency.
- 2.3.4a PS The teacher will develop lesson plans that include active inquiry lessons where students are collecting, analyzing and interpreting data.
- 2.3.4b PS The teacher will develop lesson plans that allow students to engage in developing and using models, constructing explanations and designing solutions, engaging in argument from evidence, and evaluating and communicating information.

Standard 3: Safety

Effective teachers of science demonstrate and implement safety procedures, material safety practices, and the ethical treatment and use of living organisms (appropriate to their area of licensure).

Function 1: The teacher implements safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials.

Content Knowledge

3.1.1 CK The teacher understands safety considerations affecting the purchase, storage, maintenance, and disposal of materials such as minimizing quantities in ordering, tracking usage of materials and production of waste, and keeping current on inventory of materials.

3.1.2 CK The teacher understands proper techniques and precautions for controlling access to materials in the student laboratory including appropriate dispensing, supervision of materials, and handling of waste.

Professional Skill

3.1.3 PS The teacher understands, applies, and promotes the maintenance of a safe environment in accordance with the recommendations of the National Science Teachers Association.

3.1.4 PS The teacher maintains an orderly environment, uses safe and appropriate storage of materials and equipment, and minimizes clutter so as to reduce the potential for accidents.

Function 2: The teacher designs and models activities to implement emergency procedures. The teacher understands the maintenance of safety equipment and follows policies and procedures that comply with established state and/or national guidelines. The teacher ensures safe science activities appropriate for the abilities of all students.

Content Knowledge

3.2.1 CK The teacher understands appropriate emergency procedures and maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines.

3.2.2 CK The teacher understands how students' developmental levels affect safety in classroom, laboratory and field environments, and considers this in designing activities to maintain a safe environment.

Professional Skill

3.2.3 PS The teacher designs and implements activities that demonstrate emergency procedures and the proper use of safety equipment in accordance with the recommendations of the National Science Teachers Association.

3.2.4 PS The teacher enforces safe science practices in activities appropriate to the abilities of all students.

Function 3: The teacher designs and implements activities that demonstrate ethical decision-making with respect to the treatment of living organisms in and out of the classroom. The teacher emphasizes safe, humane, and ethical treatment of animals and complies with the legal restrictions on the collection, keeping, use, and treatment of living organisms.

Content Knowledge

3.3.1 CK The teacher understands the principles of ethical decision-making with respect to the treatment of living organisms in and out of the classroom.

3.3.2 CK The teacher knows the legal restrictions on the collection, keeping, use, and treatment of living organisms.

3.3.3 CK The teacher is aware of hazards from exposure to allergens, toxins, and pathogens in the classroom, laboratory, or field environment.

Professional Skill

3.3.4 PS The teacher designs and implements activities that demonstrate ethical decision-making with respect to the treatment of living organisms in and out of the classroom.

3.3.5 PS The teacher complies with the legal restrictions on the collection, keeping, and use of living organisms.

Standard 4: Impact on Student Learning

Science teachers provide evidence that students' understanding of disciplinary core ideas, science and engineering practices, and crosscutting concepts have increased in sophistication as a result of instruction. Candidates provide evidence representative of the entire population they teach.

Function 1: Collect, organize, analyze, and reflect on diagnostic, formative and summative evidence of student learning.

Content Knowledge

4.1.1 CK The teacher understands the various methodologies to assess and analyze student learning, and address misconceptions.

Professional Skills

4.1.2 PS The teachers utilize knowledge of appropriate developmental levels within the classroom environment.

4.1.3 PS The teacher reflects on formative and summative assessments, and adjusts instruction appropriately.

Function 2: Provide data to show that students are able to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze the quality of evidence supporting scientific claims._

Content Knowledge

4.2.1 CK The teacher understands the distinction between science and nonscience, and can distinguish between the two.

4.2.2 CK The teacher understands the history, development and practice of science as a human endeavor.

4.2.3 CK The teacher critically analyzes the quality of evidence supporting scientific claims.

Professional Skills

4.2.4 PS The teacher demonstrates that students are able to understand the distinction between science and nonscience, and can distinguish between the two.

4.2.5 PS The teacher demonstrates that students are able to understand the history, development and practice of science as a human endeavor.

4.2.6 PS The teacher demonstrates that students are able to critically analyze the quality of evidence supporting scientific claims.

Standard 5: Professional Knowledge and Skills

Effective science teachers are aware of and engage in professional development opportunities to continually improve their knowledge and understanding of science content and pedagogy. They conduct themselves as part of the science education community.

Function 1: Teachers engage in professional development opportunities in their content field such as talks, symposiums, research opportunities, projects within their community, and/or social media._

Content Knowledge

5.1.1 CK The teacher demonstrates an awareness of professional organizations in science/education, and professional development available from these organizations.

Professional Skills

5.1.2 PS Teachers engage in professional development opportunities such as conferences, research opportunities, projects within their community, and/or social media.

Standard 6: Engineering, Technology, and the Applications of Science

The teacher demonstrates an understanding of concepts and practices of engineering, technology, and the applications of science in developing instruction for students.

Function 1: The teacher incorporates engineering design in instruction to solve problems. Engineering design includes the iterative processes of defining problems, developing solutions, and optimizing solutions.

Content Knowledge

- 6.1.1 CK The teacher can define and delimit engineering problems with precision, and specify the goals intended to be reached.
- 6.1.2 CK The teacher can develop possible solutions for a defined problem.
- 6.1.3 CK The teacher can systematically evaluate alternative solutions to engineering problems, analyzing data from tests of different solutions, and combining the best ideas into an improved solution.

Professional Skills

- 6.1.4 PS The teacher develops and implements lessons in which students use engineering design principles (define the problem, develop solutions, and optimize solutions) in applications appropriate to their content area.

Function 2: The teacher makes authentic connections among engineering, technology, science, and society._

Content Knowledge

- 6.2.1 CK The teacher understands the interdependence of science, engineering, and technology.
- 6.2.2 CK The teacher understands the influences of engineering, technology, and science to the broader society and environment.

Professional Skills

- 6.2.3 PS The teacher incorporates into instruction examples of the interdependence of science, engineering, and technology. Examples include: 1) advances in scientific understanding in genetics can be translated into medical treatments, and 2) new technology such as advanced telescopes and probes provide new understandings of outer space.
- 6.2.4 PS The teacher incorporates into instruction examples of the influences of engineering, technology, and science to the broader society and environment. Examples include: 1) how measurement technologies have changed civilizations throughout history, and 2) how the use of natural resources has impacted the natural world.

Standard 7: Earth's Place in the Universe

Origin, evolution and properties of the Universe. Effective science teachers demonstrate an understanding of the properties of the Universe, the Earth's place within the Universe, and origin and evolution of the Universe.

Function 1: Properties of the Universe: The teacher understands and can convey to grades 6-12 students the laws of motion, lifecycles of stars and the Universe, Earth-Sun-Moon relationships, and physical properties of the Universe.

Content Knowledge

- 7.1.1 CK Teacher demonstrates an understanding of the Sun and its lifecycle.
- 7.1.2 CK Teacher demonstrates knowledge of Nuclear fusion, light spectra and compositional elements.
- 7.1.3 CK Teacher demonstrates an understanding of the movement of galaxies, composition of stars, non-stellar gasses, and background radiation.
- 7.1.4 CK Teacher demonstrates an understanding of Star Processes - processes for forming the elements.

Professional Skills

- 7.1.5 PS Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
- 7.1.6 PS Teacher can communicate scientific ideas about the way stars, over their life cycle, produce elements.
- 7.1.7 PS Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Function 2: The teacher understands and can convey to grades 6-12 students the Earth's Place within the Universe.

Content Knowledge

- 7.2.1 CK Teacher demonstrates an understanding of Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- 7.2.2 CK Teacher demonstrates an understanding of Laws of motions and orbiting objects.

Professional Skills

- 7.2.3 PS Teacher can develop and use a model of the Earth-Sun-Moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- 7.2.4 PS The teacher can use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Function 3: The teacher understands and can convey to grades 6-12 students the Origin and Evolution of the Universe.

Content Knowledge

7.3.1 CK The teacher understands the Big Bang Theory.

7.3.2 CK The teacher understands supporting evidence for the formation of the Earth and our solar system.

Professional Skills

7.3.3 PS Teacher can construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

7.3.4 PS Teacher can apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

Standard 8: Earth's Materials and Systems

The teacher of earth and space science demonstrates an understanding of the energy sources, processes and cycles within the Earth System.

Function 1: The teacher understands and can convey to grades 6-12 students the cyclic nature of earth processes.

Content Knowledge

- 8.1.1 CK Teacher demonstrates an understanding of the rock cycle.
- 8.1.2 CK Teacher demonstrates an understanding of the carbon cycle.
- 8.1.3 CK Teacher demonstrates an understanding of the hydrologic cycle.
- 8.1.4 CK Teacher demonstrates an understanding of the Geological Time Scale.

Professional Skills

- 8.1.5 PS The teacher can describe the processes involved in the formation of rocks that included sedimentary, igneous and metamorphic rocks.
- 8.1.6 PS The teacher can describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
- 8.1.7 PS The teacher can explain the cyclic nature of water in the Earth-system, that includes the properties of water and its effects on Earth materials and surface processes.
- 8.1.8 PS The teacher can convey a scientific explanation based on evidence from rock strata for how the geologic timescale is used to organize Earth's 4.6-billion-year-old history.

Function 2: The teacher understands and can convey to grades 6-12 students the source of energy driving Earth processes.

Content Knowledge

- 8.2.1 CK Teacher demonstrates an understanding of the Internal and External earth energy.

Professional Skills

- 8.2.2 PS Teacher can illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Function 3: The teacher understands and can convey to grades 6-12 students the transfer of energy between systems.

Content Knowledge

- 8.3.1 CK Teacher demonstrates an understanding of the Conduction, Convection / Advection and Radiation.

Professional Skills

- 8.3.2 PS Teacher can develop a model based on evidence of Earth's interior to

describe the cycling of matter by thermal convection.

Function 4: The teacher understands and can convey to grades 6-12 students Plate Tectonics and Large-Scale System Interactions.

Content Knowledge

8.4.1 CK The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.

Professional Skills

8.4.2 PS Teacher can illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

Standard 9: Earth and human activity

The teacher of Earth and Space sciences demonstrates an understanding of society's interactions with the planet. How Earth's processes affect humans and human culture, and how humans affect Earth's systems.

Function 1: The teacher understands and can convey to grades 6-12 students the concepts of Natural hazards and disasters.

Content Knowledge

9.1.1 CK Teacher demonstrates an understanding of the causes of disasters; how to identify and mitigate the impact of disasters such as volcanoes, earthquakes, mass-wasting, hurricanes, floods, tornadoes.

9.1.2 CK Teacher demonstrates an understanding of hazards that impact human society.

Professional Skills

9.1.3 PS Teacher can construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

9.1.4 PS Teacher can construct an explanation based on evidence for how natural hazards have influenced human activity.

Function 2: The teacher understands and can convey to grades 6-12 students the concepts of Atmospheric & Climate Changes.

Content Knowledge

9.2.1 CK Teacher demonstrates an understanding of weather and climate effects on humans, global climate change, and oceanic effects on hydrologic/atmospheric systems.

Professional Skills

9.2.2 PS Teacher can construct an explanation based on evidence for how changes in climate have influenced human activity.

9.2.3 PS Teacher can incorporate into instruction geoscience data and results from global climate models to make evidence-based forecasts of the current rate of global or regional climate change and associated future impacts to Earth's system.

Function 3: The teacher understands and can convey to grades 6-12 students the concept of Natural Resources.

Content Knowledge

9.3.1 CK Teacher demonstrates an understanding of Water, fossil fuels, ores, industrial uses, solar, wind.

9.3.2 CK The teacher demonstrated an understanding of the impacts of human activity on natural systems.

Professional Skills

9.3.3 PS Teacher can construct an explanation based on evidence for how the availability of natural resources have influenced human activity.

9.3.4 PS Teacher can explain design solutions for developing, managing, and utilizing energy and mineral resources.

9.3.5 PS Teacher can illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

For more information, contact:

Teacher Licensure
785-296-2288
HEAccreditation@ksde.gov



Kansas State Department of Education
900 S.W. Jackson Street, Suite 102
Topeka, Kansas 66612-1212
www.ksde.gov

The Kansas State Department of Education does not discriminate on the basis of race, color, religion, national origin, sex, disability or age in its programs and activities and provides equal access to the Boy Scouts and other designated youth groups. The following person has been designated to handle inquiries regarding the nondiscrimination policies: KSDE General Counsel, Office of General Counsel, KSDE, Landon State Office Building, 900 S.W. Jackson, Suite 102, Topeka, KS 66612, (785) 296-3201.