



Field 044: Science—Earth/Space Science **REPA Educator Standards**

Standard 1: The Nature and Processes of Science

Earth and space science teachers have a broad and comprehensive understanding of the nature of science and the processes of scientific inquiry, including:

- 1.1** the characteristics, assumptions, and goals of science
- 1.2** the tentative nature of scientific knowledge, which is subject to change as new evidence, new tools, or new ways of thinking become available
- 1.3** the formulation of testable hypotheses and the principles and procedures for designing and conducting scientific investigations
- 1.4** common tools, materials, and technology used in Earth and space science investigations
- 1.5** the collection, organization, analysis, interpretation, and communication of scientific data, including the use of technology
- 1.6** the safe execution of laboratory exercises and safe storage and disposal of chemicals and materials
- 1.7** the role and applications of mathematics in science
- 1.8** the characteristics and uses of various sources of scientific information and the evaluation of scientific information, claims, and arguments
- 1.9** the role of peer review and critical evaluation of the results of scientific investigations, models, and explanations

Standard 2: Central Concepts and Connections in Science

Earth and space science teachers have a comprehensive understanding of the core ideas in other science disciplines and of the relationships between science, engineering, technology, and society, including:

- 2.1** the unifying concepts and processes that cut across the sciences and engineering
- 2.2** the basic concepts and major principles of physical science
- 2.3** the basic concepts and major principles of life science
- 2.4** the basic characteristics, principles, and goals of the engineering, or technological, design process
- 2.5** the interconnections between the various disciplines of science
- 2.6** the interrelationships between science and technology
- 2.7** the social, cultural, and ethical aspects of science and technology
- 2.8** the historical development of important ideas in science from different periods and cultures

Standard 3: Stars, Galaxies, and the Universe

Earth and space science teachers have a broad and comprehensive understanding of the origin, structure, and components of the universe, including:

- 3.1** the Big Bang theory of the universe's origin, evidence supporting the Big Bang theory, the scale and evolution of the universe, and Hubble's law
- 3.2** the Hertzsprung-Russell diagram, characteristics and life cycles of different types of stars, and the nucleosynthesis of elements
- 3.3** characteristics of supernovae, black holes, white dwarfs, and neutron stars
- 3.4** characteristics and formation of different types of galaxies
- 3.5** the role of gravity in the formation of stars and galaxies
- 3.6** characteristics of different types of telescopes and the principles and applications of spectroscopy

Standard 4: Earth and the Solar System

Earth and space science teachers have a broad and comprehensive understanding of the solar system and the sun-moon-Earth system, including:

- 4.1** the nebular theory of the solar system's origin, planetesimals, and protoplanets
- 4.2** asteroids, comets, the Oort cloud, the Kuiper belt, and the asteroid belt
- 4.3** the composition, orientation, and orbital characteristics of the planets and their moons
- 4.4** Earth's place in the solar system, its orbit, axial rotation, and planetary characteristics
- 4.5** the sun-moon-Earth system and its relationship to ocean tides, seasons, day length, and Earth's energy budget
- 4.6** solar and lunar eclipses, the phases of the moon, and the origin and characteristics of the moon
- 4.7** the apparent motion of objects in the sky and the celestial sphere model
- 4.8** the role of gravity in the formation of the solar system, Newton's laws, and Kepler's laws of planetary motion

Standard 5: Earth's Origin, Evolution, and Structure

Earth and space science teachers have a broad and comprehensive understanding of the origin, evolution, and structure of Earth, including:

- 5.1** origin of Earth in the early solar system and the evolution of the hydrosphere, atmosphere, lithosphere, and biosphere
- 5.2** Earth's internal structure and the properties and physical and chemical characteristics of Earth's layered interior
- 5.3** the use of seismology in the study of Earth's interior
- 5.4** the properties and source of Earth's magnetic field and its effect on other Earth systems
- 5.5** the geologic time scale, the fossil record, and the principles and applications of modern evolutionary theory
- 5.6** the principles and applications of radiometric dating, relative dating, and stratigraphy
- 5.7** the geologic history of Indiana

Standard 6: Earth Processes and Materials

Earth and space science teachers have a broad and comprehensive understanding of the physical and chemical processes that shape Earth's surface and the materials that Earth is composed of, including:

- 6.1** the characteristics, identification, and composition of rocks and minerals, including the rocks and minerals of Indiana
- 6.2** interactions between the hydrosphere, atmosphere, lithosphere, and biosphere
- 6.3** the theory of and supporting evidence for plate tectonics
- 6.4** processes involved in the formation of igneous, metamorphic, and sedimentary rocks
- 6.5** different types of igneous activity and volcanism
- 6.6** earthquakes, geologic faulting, and folding
- 6.7** weathering, erosion, and deposition
- 6.8** glacial processes and the effects of continental glaciations on Indiana and the Great Lakes region
- 6.9** soil formation processes and the characteristics of different soil types, including the soils of Indiana

Standard 7: Freshwater Systems and the Oceans

Earth and space science teachers have a broad and comprehensive understanding of the hydrosphere, including:

- 7.1** the physical and chemical properties of water
- 7.2** freshwater lakes, ponds, and wetlands
- 7.3** groundwater aquifers, watersheds, and groundwater flow processes
- 7.4** the evolution and characteristics of river systems under different geographic conditions
- 7.5** the characteristics and evolution of ocean basins
- 7.6** the physical and chemical properties of ocean water
- 7.7** characteristics of surface currents and thermohaline circulation
- 7.8** characteristics of ocean waves and coastal processes
- 7.9** surface water and groundwater systems in Indiana and the Great Lakes region

Standard 8: The Atmosphere, Weather, and Climate

Earth and space science teachers have a broad and comprehensive understanding of the atmosphere, weather, and climate, including:

- 8.1** the structure, composition, and properties of the atmosphere's different layers
- 8.2** the processes of energy transfer to and within the atmosphere
- 8.3** the physical and biological characteristics of the world's different climate regions
- 8.4** the global climate system, changes in climate over geologic time, and recent climate change
- 8.5** weather systems, air masses, fronts, the polar-front and subtropical jet streams, air pressure, and local and global winds
- 8.6** thunderstorms, tornadoes, middle latitude cyclones, hurricanes, and other types of severe weather
- 8.7** weather conditions and events that commonly affect Indiana, including lake-effect snow and blizzards
- 8.8** weather maps, computer models, and the tools and technologies used in meteorology and climatology

Standard 9: Biogeochemical Cycles, Geologic Resources, and the Environment

Earth and space science teachers have a broad and comprehensive understanding of the cycling of matter through biogeochemical cycles, the use and management of geologic resources, and the effects of human activities on the environment, including:

- 9.1** the physical and chemical processes of the carbon cycle and its relationship to human activities, the climate system, and ocean chemistry
- 9.2** the phosphorus and nitrogen cycles and their relationship to human activities and the biosphere
- 9.3** the formation, extraction, use, and management of mineral resources and fossil fuels, including those found in Indiana and the surrounding region
- 9.4** the scientific principles underlying the use and development of solar energy, geothermal energy, and wind energy
- 9.5** the environmental effects of human activities on local and global scales

Standard 10: Science Instruction and Assessment

Earth and space science teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science, including:

- 10.1** the Indiana Revised Academic Standards for Science
- 10.2** the National Science Education Standards, the NCATE/NSTA Standards for Science Teacher Preparation, the Common Core State Standards for Literacy: Science and Technical Subjects, and the ISTE National Educational Technology Standards
- 10.3** instructional strategies and resources for promoting students' development of conceptual understanding, inquiry skills, and scientific habits of mind
- 10.4** strategies and skills for planning and designing science instruction, including the use of techniques and approaches that meet the needs of diverse learners
- 10.5** instructional strategies and communication methods that encourage active inquiry, supportive interaction, and collaboration in the science classroom
- 10.6** strategies and resources for promoting students' reading, writing, and mathematics skills in science
- 10.7** strategies and skills for selecting, adapting, and using technological resources to enhance teaching and learning in science
- 10.8** procedures, resources, and guidelines for maintaining a safe science learning environment
- 10.9** strategies and skills for effectively assessing student understanding and mastery of essential science concepts and skills