



## **Field 036: Middle School Science REPA Educator Standards**

### **Standard 1: The Nature and Processes of Science**

**Middle school 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 scientific 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**

**Middle school science teachers have a comprehensive understanding of the core ideas and principles that connect different scientific 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 core ideas and principles that connect the various disciplines of science
- 2.3** the basic characteristics, principles, and goals of the engineering, or technological, design process
- 2.4** the interrelationships between science and technology
- 2.5** the social, cultural, and ethical aspects of science and technology
- 2.6** the historical development of important ideas in science from different periods and cultures

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### **Standard 3: Chemistry**

**Middle school science teachers have a broad and comprehensive understanding of chemistry, including:**

- 3.1** the characteristics and arrangement of subatomic particles and historical and contemporary models of the atom
- 3.2** the organization of the periodic table and periodic trends in the chemical and physical properties of matter
- 3.3** the properties of the different states of matter, kinetic molecular theory, the gas laws, and the concepts of heat and temperature
- 3.4** distinguishing characteristics of elements, compounds, and mixtures
- 3.5** principles of chemical bonding and types and characteristics of chemical bonds and their effects on the properties of matter
- 3.6** types and characteristics of chemical reactions and factors that affect reaction rates and equilibrium
- 3.7** the law of conservation of mass and the principles of stoichiometry and their application in balancing chemical equations
- 3.8** the mole concept and its application in chemical calculations
- 3.9** acids and bases and their characteristic properties
- 3.10** forms of energy and the transformation of energy from one form to another
- 3.11** energy transfers through conduction, convection, and radiation
- 3.12** energy changes associated with physical processes and chemical reactions and principles and applications of the first and second laws of thermodynamics

### **Standard 4: Physics**

**Middle school science teachers have a broad and comprehensive understanding of physics, including:**

- 4.1** Newton's laws of motion and universal gravitation and their application
- 4.2** the vector nature of force and motion and the concepts of displacement, velocity, and acceleration
- 4.3** the principles of work, energy, and power and the characteristics and uses of simple machines
- 4.4** characteristics of energy transfer by mechanical waves in air, water, and Earth materials
- 4.5** the amplitude, wavelength, frequency, and period of mechanical waves
- 4.6** properties of sound waves and their propagation in different media
- 4.7** the electromagnetic spectrum and the propagation of electromagnetic energy
- 4.8** the refraction, absorption, and reflection of electromagnetic waves
- 4.9** the nature of light and the properties and operation of lenses and mirrors
- 4.10** electrostatics, conservation of charge, and Coulomb's law
- 4.11** electricity, electric current, potential difference, resistance, and parallel and series circuits
- 4.12** the properties of permanent magnets and the principles and applications of electromagnetic induction

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## **Standard 5: Earth and Space Science**

**Middle school science teachers have a broad and comprehensive understanding of Earth and space science, including:**

- 5.1** the origin, structure, and components of the universe
- 5.2** the characteristics of the solar system and planets and the effects of the sun and moon on Earth systems
- 5.3** the origin, evolution, structure, and composition of Earth
- 5.4** the geologic time scale, evidence for the major events in the history and origin of Earth, and the principles and applications of radiometric dating and stratigraphy
- 5.5** processes involved in the formation of igneous, metamorphic, and sedimentary rocks
- 5.6** the processes of weathering, erosion, and deposition and the origin of major landforms
- 5.7** the characteristics, identification, and composition of rocks and minerals
- 5.8** the causes and consequences of volcanic activity and earthquakes
- 5.9** the theory of and supporting evidence for plate tectonics
- 5.10** the characteristics and processes of freshwater systems, oceans, and glaciers and the physical and chemical properties of water
- 5.11** the structure and processes of the atmosphere and the causes and characteristics of different types of weather
- 5.12** physical and biological characteristics of Earth's different climate regions, the global climate system, and changes in climate that have occurred over the course of human history and geologic time
- 5.13** the cycling of matter through biogeochemical cycles, the use and management of geologic resources, and the effects of human activities on the environment

## **Standard 6: Life Science**

**Middle school science teachers have a broad and comprehensive understanding of the life sciences, including:**

- 6.1** the structure and function of plant and animal cells and cell organelles
- 6.2** the characteristics of bacteria and protists
- 6.3** the processes of photosynthesis and cellular respiration
- 6.4** the characteristics and function of specialized cells in plants and animals
- 6.5** the structure of DNA and RNA and the processes of replication, transcription, translation, and protein synthesis
- 6.6** the processes of cell division and the molecular basis of heredity
- 6.7** the principles of genetics, patterns of inheritance, and their application to genetics problems
- 6.8** the basic principles, methods, and applications of genetic engineering
- 6.9** the structure and function of organ systems in plants, animals, and fungi
- 6.10** basic anatomy and physiology of the primary components of human body systems
- 6.11** modern evolutionary theory and its supporting evidence and the process of natural selection
- 6.12** the interactions between living and nonliving components of ecosystems and the relationships between organisms in ecosystems
- 6.13** the impact of human activities and natural phenomena on ecosystems and the effects of such changes on biodiversity

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### **Standard 7: Energy and Society**

**Middle school science teachers have a broad and comprehensive understanding of the production and use of energy and the effects of energy use on society and the environment, including:**

- 7.1** the benefits and risks associated with the extraction, use, and management of nonrenewable energy resources, such as coal, oil, natural gas, and uranium
- 7.2** the benefits and risks associated with the development of renewable forms of energy, such as wind energy, solar energy, geothermal energy, water power, and biofuels
- 7.3** the production and transmission of electric power from different types of power plants to homes and businesses
- 7.4** the use of energy in homes, different types of industries, and transportation and strategies for reducing energy use through technological innovation and conservation
- 7.5** the use of energy and natural resources in industrialized, developing, and underdeveloped nations and the role of energy resources in the development of an economically viable society

### **Standard 8: Middle School Science Instruction and Assessment**

**Middle school science teachers have a broad and comprehensive understanding of content-specific instruction and assessment in science, including:**

- 8.1** the Indiana Revised Academic Standards for Science
- 8.2** 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
- 8.3** instructional strategies and resources for promoting students' development of conceptual understanding, inquiry skills, and scientific habits of mind
- 8.4** strategies and skills for planning and designing science instruction, including the use of techniques and approaches that meet the needs of diverse learners
- 8.5** instructional strategies and communication methods that encourage active inquiry, supportive interaction, and collaboration in the science classroom
- 8.6** strategies and resources for promoting students' reading, writing, and mathematics skills in science
- 8.7** strategies and skills for selecting, adapting, and using technological resources to enhance teaching and learning in science
- 8.8** procedures, resources, and guidelines for maintaining a safe science learning environment
- 8.9** strategies and skills for effectively assessing student understanding and mastery of essential science concepts and skills