

**CERTIFICATION EXAMINATIONS  
FOR OKLAHOMA EDUCATORS™ (CEOE™)**

**OKLAHOMA SUBJECT AREA TESTS™ (OSAT™)**

**FIELD 026: MIDDLE LEVEL SCIENCE**

**TEST FRAMEWORK**

**September 2008**

<b>Subarea</b>	<b>Range of Competencies</b>
I. Foundations of Scientific Inquiry	01–04
II. Life Science	05–09
III. Physical Science	10–15
IV. Earth and Space Science	16–19

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# OKLAHOMA SUBJECT AREA TESTS™ (OSAT™)

## FIELD 026: MIDDLE LEVEL SCIENCE TEST FRAMEWORK

- I. Foundations of Scientific Inquiry
- II. Life Science
- III. Physical Science
- IV. Earth and Space Science

### SUBAREA I—FOUNDATIONS OF SCIENTIFIC INQUIRY

#### Competency 0001

##### **Understand the process of scientific inquiry.**

*The following topics are examples of content that may be covered under this competency.*

- Recognize the characteristics of different types of scientific investigations (e.g., observations, controlled experiments).
- Analyze the processes by which scientific knowledge and hypotheses are generated.
- Demonstrate knowledge of the principles of experimental design (e.g., dependent and independent variables, experimental controls and constants).
- Recognize appropriate questions to ask in a given scientific context and the appropriateness of a given experimental design to test a hypothesis.

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**Competency 0002**

**Understand the historical and contemporary contexts of the study of science and the common themes that connect science and technology.**

*The following topics are examples of content that may be covered under this competency.*

- Analyze the significance of key events, theories, and experiments in the history of science.
- Identify the scientific contributions of individuals and societies of different periods and cultures.
- Identify ethical, environmental, and health issues associated with scientific developments and new technologies.
- Analyze the interrelationship of science and technology in scientific investigations and in daily life.
- Recognize the characteristics and uses of different types of models (e.g., scale models, simulations, formulas) in science and technology.
- Identify general concepts common to science and technology (e.g., order, scale, modeling, cause and effect, systems, constancy).

**Competency 0003**

**Understand the principles of measurement and the processes of gathering, organizing, reporting, and interpreting scientific data.**

*The following topics are examples of content that may be covered under this competency.*

- Identify procedures for gathering and collecting relevant and reliable data in a given situation.
- Analyze procedures and formats used in organizing, reporting, and interpreting scientific data (e.g., tables, charts, graphs).
- Solve problems involving measurement and basic computation, using the International System of Units (SI) and scientific notation.
- Apply descriptive statistics in the analysis of data.

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**Competency 0004**

**Understand the equipment, materials, and chemicals used in scientific inquiry; and apply procedures for their proper, safe, and legal use.**

*The following topics are examples of content that may be covered under this competency.*

- Recognize procedures for the safe and proper use of common laboratory equipment (e.g., balances, glassware, thermometers, microscopes) and materials in various types of scientific investigations.
- Identify procedures for the safe storage, use, and disposal of common laboratory chemicals according to material safety data sheet (MSDS) guidelines.
- Identify procedures for the ethical treatment and safe handling of organisms (e.g., animals, specimens both in and out of the classroom).
- Apply procedures for promoting laboratory safety and appropriately responding to accidents and injuries in the science laboratory.
- Recognize how computers are used in scientific investigations.

**SUBAREA II—LIFE SCIENCE**

**Competency 0005**

**Understand the basic concepts of cell biology.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the components and principles of the cell theory.
- Recognize structures in prokaryotic and eukaryotic cells and their functions (e.g., plant cells, animal cells, bacteria).
- Identify the role of organic molecules (e.g., proteins, DNA, carbohydrates) in cells and organisms.

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**Competency 0006**

**Understand the diversity of life and life processes.**

*The following topics are examples of content that may be covered under this competency.*

- Recognize the characteristics and classification of major groups of organisms.
- Analyze the processes of photosynthesis and cellular respiration.
- Recognize how organisms grow, reproduce, and maintain homeostasis.
- Identify the structure, components, functions, and physiological processes of organs and systems in plants and animals, including humans.

**Competency 0007**

**Understand genetics and biological adaptation.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the structure and function of genes and chromosomes.
- Analyze processes by which characteristics are passed on from parents to offspring.
- Analyze the roles of variation, natural selection, and adaptation in biological evolution.
- Recognize the paleontological and genetic evidence for biological evolution.

**Competency 0008**

**Understand populations, communities, ecosystems, and biomes.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the characteristics of populations, communities, and ecosystems.
- Analyze factors that affect population growth and community interactions.
- Analyze the movement of energy and materials through the trophic levels of an ecosystem.
- Recognize the physical and biological characteristics of the earth's biomes (e.g., grassland, tundra, rainforest).

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**Competency 0009**

**Understand the effect of humans on the environment.**

*The following topics are examples of content that may be covered under this competency.*

- Identify sources of environmental pollutants and strategies for controlling pollution.
- Analyze the effects of humans on natural processes and environments.
- Analyze techniques and procedures for protecting the environment.
- Recognize the characteristics of natural resources and strategies for their management.

**SUBAREA III—PHYSICAL SCIENCE**

**Competency 0010**

**Understand the structure and nature of matter.**

*The following topics are examples of content that may be covered under this competency.*

- Recognize historic and contemporary theories of the atom and the kinetic theory of matter.
- Identify the physical and chemical characteristics of matter (e.g., density, mass, volume, state, reactivity).
- Recognize the characteristics of elements, pure substances, compounds, mixtures, and solutions.
- Recognize types and characteristics of chemical bonding and its relationship to molecular structures.
- Analyze the organization of the periodic table in terms of its relationship to atomic structure and both chemical and physical properties of elements.

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**Competency 0011**

**Understand physical, chemical, and nuclear changes in matter.**

*The following topics are examples of content that may be covered under this competency.*

- Distinguish between physical and chemical changes and their characteristics.
- Apply knowledge of the conservation of mass to balance chemical equations.
- Demonstrate knowledge of chemical formulas, the mole concept, and chemical notation to solve problems.
- Recognize the characteristics of different types of chemical reactions (e.g., acid-base, oxidation-reduction).
- Analyze phase changes and the characteristics of the different states of matter.
- Identify characteristics of nuclear changes in matter.

**Competency 0012**

**Understand the basic concepts of force, motion, and work.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the forces (e.g., gravity, the normal force, friction, buoyant force) affecting an object.
- Apply Newton's laws of motion to interpret and predict the motion of objects in a variety of situations.
- Analyze simple machines and the principles of work and power.

**Competency 0013**

**Understand energy and its forms and transformations.**

*The following topics are examples of content that may be covered under this competency.*

- Identify forms of energy (e.g., electrical, mechanical, thermal, nuclear) and their characteristics.
- Demonstrate knowledge of the law of conservation of energy in various situations, including physical and chemical changes.
- Analyze the transfer of thermal energy through conduction, convection, and radiation.
- Recognize the characteristics of mechanical energy and the relationship between kinetic and potential energy.

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**Competency 0014**

**Understand waves, sound, and light.**

*The following topics are examples of content that may be covered under this competency.*

- Interpret concepts associated with waves, sound, and light (e.g., frequency, amplitude, wavelength, pitch, loudness, color).
- Apply knowledge of refraction, reflection, and constructive and destructive interference to explain the behavior of light and sound waves.
- Analyze the properties and propagation of sound and light in a variety of real-world situations (e.g., rainbows, echoes, Doppler effect, shadows).
- Recognize the characteristics of the electromagnetic spectrum.

**Competency 0015**

**Understand electricity, magnets, and electromagnetism.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the characteristics of static electricity and current electricity.
- Demonstrate knowledge of the properties of permanent magnets and the relationship between electricity and magnetism.
- Recognize the characteristics of parallel and series circuits.
- Recognize how electricity is generated (e.g., wind, water, sun, fossil fuel) and used in everyday life.



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**SUBAREA IV—EARTH AND SPACE SCIENCE**

**Competency 0016**

**Understand geology and geologic processes.**

*The following topics are examples of content that may be covered under this competency.*

- Demonstrate knowledge of the characteristics of rocks, minerals, and soils and their formation.
- Analyze the structure and composition of the earth and the evidence supporting the theory of plate tectonics.
- Analyze processes of the rock cycle and the effect of these processes on the earth's systems.
- Recognize major events in the earth's history and principles and methods of relative and absolute dating techniques.
- Interpret maps commonly used in earth science (e.g., topographic maps, globes, map projections) and geologic cross sections.

**Competency 0017**

**Understand the hydrosphere.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the chemical and physical characteristics of freshwater and seawater (e.g., specific heat, density, salinity).
- Identify characteristics and processes of the water cycle (e.g., condensation, precipitation, transpiration).
- Recognize the characteristics of freshwater systems, including factors that affect the movement of surface water and groundwater (e.g., soil characteristics, wells, water budgets).
- Identify factors that affect the biological productivity of bodies of water.
- Demonstrate knowledge of ocean basins, ocean circulation, and coastal processes.

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**Competency 0018**

**Understand weather, climate, and the earth's atmosphere.**

*The following topics are examples of content that may be covered under this competency.*

- Identify the structure, functions, and characteristics of the earth's atmosphere.
- Analyze the role of air masses, fronts, and the jet stream in producing different weather conditions, including hazardous weather.
- Recognize processes related to precipitation and cloud formation.
- Identify equipment and methods used to predict and interpret weather and climate changes.
- Recognize the potential effects of climate change and weather events on societies and ecosystems.

**Competency 0019**

**Understand basic astronomy.**

*The following topics are examples of content that may be covered under this competency.*

- Analyze theories of the structure, origin, and evolution of the solar system and universe.
- Recognize the interactions and motions of the earth, sun, and moon that produce seasons, tides, and eclipses.
- Identify the components of the solar system (e.g., sun, planets, moons, asteroids) and their characteristics, interactions, and movements.
- Identify the characteristics of stars and galaxies (e.g., types, life cycles).
- Identify equipment used to study space and the effect that space exploration has had on society and technological developments.