

## Earth Science : Embedded Inquiry

### Conceptual Strand

*Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21<sup>st</sup> century.*

### Guiding Question

*What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?*

<b>Course Level Expectations</b>	<b>Checks for Understanding</b>
<p><b>CLE 3204.Inq.1</b> Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.</p> <p><b>CLE 3204.Inq.2</b> Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.</p> <p><b>CLE 3204.Inq.3</b> Use appropriate tools and technology to collect precise and accurate data.</p> <p><b>CLE 3204.Inq.4</b> Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.</p> <p><b>CLE 3204.Inq.5</b> Compare experimental evidence and conclusions with those drawn by others about the same testable question.</p> <p><b>CLE 3204.Inq.6</b> Communicate and defend scientific findings.</p>	<p>✓<b>3204.Inq.1</b> Trace the historical development of a scientific principle or theory, such as plate tectonics, evolution of the cosmos, and global change.</p> <p>✓<b>3204.Inq.2</b> Conduct scientific investigations that include testable questions, verifiable hypotheses, and appropriate variables to explore new phenomena or verify the experimental results of others.</p> <p>✓<b>3204.Inq.3</b> Select appropriate tools and technology to collect precise and accurate quantitative and qualitative data.</p> <p>✓<b>3204.Inq.4</b> Determine if data supports or contradicts a hypothesis or conclusion.</p> <p>✓<b>3204.Inq.5</b> Compare or combine experimental evidence from two or more investigations.</p> <p>✓<b>3204.Inq.6</b> Recognize, analyze, and evaluate alternative explanations</p>

	<p>for the same set of observations.</p> <p>✓<b>3204.Inq.7</b> Evaluate the accuracy and precision of data.</p> <p>✓<b>3204.Inq.8</b> Analyze experimental results and identify possible sources of bias or experimental error.</p> <p>✓<b>3204.Inq.9</b> Formulate and revise scientific explanations and models using logic and evidence.</p>
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<h2 style="margin: 0;">Earth Science : Embedded Technology &amp; Engineering</h2>	
<p><b>Conceptual Strand</b>  <i>Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.</i></p>	
<p><b>Guiding Question</b>  <i>How do science concepts, engineering skills, and applications of technology improve the quality of life?</i></p>	
<p><b>Course Level Expectations</b></p>	<p><b>Checks for Understanding</b></p>

<p><b>CLE 3204.T/E.1</b> Explore the impact of technology on social, political, and economic systems.</p> <p><b>CLE 3204.T/E.2</b> Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.</p> <p><b>CLE 3204.T/E.3</b> Explain the relationship between the properties of a material and the use of the material in the application of a technology.</p> <p><b>CLE 3204.T/E.4</b> Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.</p>	<p>✓<b>3204.T/E.1</b> Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.</p> <p>✓<b>3204.T/E.2</b> Apply the engineering design process to construct a prototype that meets developmentally appropriate specifications.</p> <p>✓<b>3204.T/E.3</b> Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.</p> <p>✓<b>3204.T/E.4</b> Explore how the unintended consequences of new technologies can impact human and non-human communities.</p> <p>✓<b>3204.T/E.5</b> Evaluate the overall benefit to cost ratio of a new technology.</p> <p>✓<b>3204.T/E.6</b> Present research on current bioengineering technologies that advance health and contribute to improvements in our daily lives.</p> <p>✓<b>3204.T/E.7</b> Design a series of multi-view drawings that can be used by other students to construct an adaptive design and test its effectiveness.</p>
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<h2 style="text-align: center; margin: 0;">Earth Science : Standard 1 – The Universe</h2>
<p><b>Conceptual Strand 1</b></p> <p style="text-align: center;"><i>The cosmos is vast and explored well enough to know its basic structure and operational principles.</i></p>
<p><b>Guiding Question 1</b></p> <p style="text-align: center;"><i>What big ideas guide human understanding about the origin and structure of the universe, Earth’s place in the cosmos, and observable motions and patterns in the sky?</i></p>

<b>Grade Level Expectations</b>	<b>Checks for Understanding</b>
<p><b>CLE 3204.1.1</b> Explore theories for the origin and evolution of the universe.</p> <p><b>CLE 3204.1.2</b> Examine the components of the solar system.</p> <p><b>CLE 3204.1.3</b> Explore the sun, earth, and moon relationships and their gravitational effects.</p> <p><b>CLE 3204.1.4</b> Investigate the history of space exploration.</p>	<p>✓<b>3204.1.1</b> Identify the components of the universe: black holes, galaxies, nebulae, solar systems, stars, planets, meteors, comets, and asteroids.</p> <p>✓<b>3204.1.2</b> Compare explanations for the origin of the universe: Big Bang, nucleosynthesis, galaxy, and star formation.</p> <p>✓<b>3204.1.3</b> Construct a solar system model that illustrates ratios and proportions of distance and size of planets.</p> <p>✓<b>3204.1.4</b> Explain the evolution of a star through stages of its development.</p> <p>✓<b>3204.1.5</b> Classify galaxies according to shape.</p> <p>✓<b>3204.1.6</b> Explore the role of astronomical events in the earth's history: asteroid/meteor impacts, solar flares, and comets.</p> <p>✓<b>3204.1.7</b> Compare and contrast the earth with other planets in the solar system.</p> <p>✓<b>3204.1.8</b> Investigate the seasonal relationships between the length of the day and the inclination and relative positions of the sun and earth.</p> <p>✓<b>3204.1.9</b> Describe the position of the sun, earth, and moon during eclipses and different lunar phases.</p> <p>✓<b>3204.1.10</b> Predict tidal conditions based upon the position of the earth, moon, and sun.</p> <p>✓<b>3204.1.11</b> Describe the relationship between the mass of an object</p>

	<p>and its gravitational force.</p> <p>✓<b>3204.1.12</b> Construct a historical timeline that depicts man's changing perceptions and understanding of astronomy.</p> <p>✓<b>3204.1.13</b> Understand how telescopes and spectroscopy manipulate light to reveal information about the universe.</p> <p>✓<b>3204.1.14</b> Investigate the history of space exploration.</p> <p>✓<b>3204.1.15</b> Research Tennessee's contribution to earth and space science.</p>
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<b>Earth Science : Standard 2 - Energy in the Earth System</b>	
<b>Conceptual Strand 2</b> <i>Energy cycles drive the earth system.</i>	
<b>Guiding Question 2</b> <i>What are the scientific explanations for how energy cycles through the earth system?</i>	
<b>Course Level Expectations</b>	<b>Checks For Understanding</b>
<p><b>CLE 3204.2.1</b> Investigate the principal sources of energy.</p> <p><b>CLE 3204.2.2</b> Explore pathways of energy transfer.</p> <p><b>CLE 3204.2.3</b> Evaluate alternative energy sources.</p>	<p>✓<b>3204.2.1</b> Differentiate among the various forms of energy.</p> <p>✓<b>3204.2.2</b> Illustrate three types of energy transfer: radiation, conduction, and convection.</p> <p>✓<b>3204.2.3</b> Describe different types of energy resources: fossil fuels,</p>

solar, geothermal, nuclear, wind, and hydroelectric.

✓**3204.2.4** Distinguish between renewable and nonrenewable resources in terms of resource conservation.

✓**3204.2.5** Investigate how the sun provides the major source of earth's surface energy.

✓**3204.2.6** Explore three primary sources of internal energy: gravitational energy from the earth's original formation, friction, and radioactive decay.

✓**3204.2.7** Diagram and evaluate pathways of energy transfer to demonstrate the law of conservation of energy.

✓**3204.2.8** Describe the energy transfer associated with different geologic events: mantle convection, rock cycle, wind, and ocean currents.

✓**3204.2.9** Describe the human impact of large scale energy transfer events: hurricanes, photosynthesis, earthquakes, volcanoes, and tsunamis.

✓**3204.2.10** Compare and contrast alternative energy sources and their environmental impact.

✓**3204.2.11** Compare energy sources and heat transfer over geologic time to current patterns of global change.

# Earth Science : Standard 3 - Cycles in the Earth System

## Conceptual Strand 3

*The earth system consists of interrelated subcycles that act over extended periods of geologic time.*

## Guiding Question 3

*What are the subcycles of the earth system and how do they interact?*

<b>Grade Level Expectations</b>	<b>Checks for Understanding</b>
<p><b>CLE 3204.3.1</b> Explain the components of the tectonic cycle.</p> <p><b>CLE 3204.3.2</b> Investigate the rock cycle.</p> <p><b>CLE 3204.3.3</b> Analyze the hydrologic cycle.</p> <p><b>CLE 3204.3.4</b> Interpret data related to the atmospheric cycle.</p> <p><b>CLE 3204.3.5</b> Differentiate among the geochemical cycles.</p> <p><b>CLE 3204.3.6</b> Evaluate the impact of living organisms on earth system cycles.</p> <p><b>CLE 3204.3.7</b> Investigate how maps can be used to interpret changes in the earth system.</p> <p><b>CLE 3204.3.8</b> Relate earth system cycles to past and current patterns of global change.</p>	<p>✓<b>3204.3.1</b> Use models to explain the theory of plate tectonics.</p> <p>✓<b>3204.3.2</b> Apply mantle convection currents to distinguish between divergent and convergent plate boundaries.</p> <p>✓<b>3204.3.3</b> Explain and map the relationship between plate tectonics and mountain building, volcanoes, and earthquakes.</p> <p>✓<b>3204.3.4</b> Distinguish between minerals and rocks.</p> <p>✓<b>3204.3.5</b> Identify minerals according to their physical properties.</p> <p>✓<b>3204.3.6</b> Distinguish among sedimentary, igneous, and metamorphic rocks.</p> <p>✓<b>3204.3.7</b> Interpret a diagram of the rock cycle.</p> <p>✓<b>3204.3.8</b> Explain a model of the hydrologic cycle.</p> <p>✓<b>3204.3.9</b> Distinguish between mechanical and chemical weathering.</p>

	<p>✓<b>3204.3.10</b> Describe the impact of water on the evolution of landforms.</p> <p>✓<b>3204.3.11</b> Collect and interpret basic weather data from meteorological instruments: thermometer, rain gauge, and barometer.</p> <p>✓<b>3204.3.12</b> Analyze weather map data to make simple predictions.</p> <p>✓<b>3204.3.13</b> Explain the oxygen/carbon dioxide, nitrogen, and carbon biogeochemical cycles.</p> <p>✓<b>3204.3.14</b> Recognize the connection between geologic processes such as floods, earthquakes, volcanoes, acid rain, global warming and human activities.</p> <p>✓<b>3204.3.15</b> Construct a geological cycle for a physiographic region or geologic time period in Tennessee.</p> <p>✓<b>3204.3.16</b> Interpret topographic maps.</p> <p>✓<b>3204.3.17</b> Relate current global patterns such as sea level change and geographic climate shifts to events that occurred during the earth's distant past.</p>
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## **Earth Science : Standard 4 – Geologic History**

### **Conceptual Strand 4**

*The earth has changed over a long period and global change is a continuation of this evolutionary process.*

### **Guiding Question 4**

*What is the scientific evidence for the evolution of earth and life on earth?*



<p style="text-align: center;"><b>Grade Level Expectations</b></p>	<p style="text-align: center;"><b>Checks for Understanding</b></p>
<p><b>CLE 3204.4.1</b> Interpret the nature of geologic time.</p> <p><b>CLE 3204.4.2</b> Investigate the evolution of the earth.</p> <p><b>CLE 3204.4.3</b> Interpret the fossil record for evidence of biological evolution.</p> <p><b>CLE 3204.4.4</b> Demonstrate the impact of environmental change on the origin and extinction of plant and animal species.</p>	<p>✓<b>3204.4.1</b> Explain the law of uniformitarianism.</p> <p>✓<b>3204.4.2</b> Differentiate between absolute and relative time.</p> <p>✓<b>3204.4.3</b> Compare and contrast how relative and absolute dating techniques are used to interpret the advance of geologic history.</p> <p>✓<b>3204.4.4</b> Construct a geologic timetable for the evolution of earth and the history of life.</p> <p>✓<b>3204.4.5</b> Interpret evidence for plate tectonics such as the fossil record, mountain range formation, rock strata, paleomagnetism, paleoclimates, and configuration of the continents.</p> <p>✓<b>3204.4.6</b> Recognize that fossils contained in sedimentary rock provide evidence of past life forms, changes in life forms, and environmental change.</p> <p>✓<b>3204.4.7</b> Determine the relative age of fossils in sedimentary rock.</p> <p>✓<b>3204.4.8</b> Interpret the sequence of rock strata using superposition, cross-cutting relationships, inclusions, the fossil record, and absolute dating techniques.</p> <p>✓<b>3204.4.9</b> Predict how an environmental change might influence the development of new species or cause the extinction of an existing species.</p>