



# Earth Science

Geology, the Environment, and the Universe

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STANDARDS	PAGE REFERENCES
<b>INQUIRY</b>	
<b>1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.</b>	
<p>a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)</p> <ul style="list-style-type: none"> <li>• Safety rules and symbols</li> </ul>	<p><b>Student Edition:</b></p>  <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Proper use and care of the compound light microscope, slides, chemicals, etc.</li> </ul>	<p><b>Student Edition:</b></p>  <p><b>Teacher Wraparound Edition:</b></p>

<ul style="list-style-type: none"> <li>Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers.</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>b. Formulate questions that can be answered through research and experimental design. (DOK 3)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 3)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<p>g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p><b>EARTH AND SPACE SCIENCE</b></p>	
<p><b>2. Develop an understanding of the history and evolution of the universe and Earth.</b></p>	
<p>a. Summarize the origin and evolution of the universe. (DOK 2)</p> <ul style="list-style-type: none"> <li>• Big Bang theory</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Microwave background radiation</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• The Hubble constant</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Evidence of the existence of dark matter and dark energy in the universe and the history of the universe</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<p>b. Differentiate methods used to measure space distances, including astronomical unit, light-year, stellar parallax, Cepheid variables, and the red shift. (DOK 1)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>c. Interpret how gravitational attraction played a role in the formation of the planetary bodies and how the fusion of hydrogen and other processes in “ordinary” stars and supernovae lead to the formation of all other elements. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Write appropriate equations for nuclear decay reactions, describe how the nucleus changes during these reactions, and compare the resulting radiation with regard to penetrating ability. (DOK 1)</p> <ul style="list-style-type: none"> <li>• Three major types of radioactive decay (e.g., alpha, beta, gamma) and the properties of the emissions (e.g., composition, mass, charge, penetrating power)</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Summarize the early evolution of the Earth, including the formation of Earth’s solid layers (e.g., core, mantle, crust), the distribution of major elements, the origin of internal heat sources, and the initiation of plate tectonics. (DOK 2)</p> <ul style="list-style-type: none"> <li>• How the decay of radioactive isotopes is used to determine the age of rocks, Earth, and the solar system</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p><b>3. Discuss factors which are used to explain the geological history of Earth.</b></p>	
<p>a. Develop an understanding of how plate tectonics create certain geological features, materials, and hazards. (DOK 1)</p> <ul style="list-style-type: none"> <li>• Plate tectonic boundaries (e.g., divergent, convergent, and transform)</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<ul style="list-style-type: none"> <li>• Modern and ancient geological features to each kind of plate tectonic boundary</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Production of particular groups of igneous and metamorphic rocks and mineral resources</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Sedimentary basins created and destroyed through time</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>b. Compare and contrast types of mineral deposits/groups (e.g., oxides, carbonates, halides, sulfides, sulfates, silicates, phosphates). (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>c. Categorize minerals and rocks by determining their physical and/or chemical characteristics. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Justify the causes of certain geological hazards (e.g., earthquakes, volcanoes, tsunamis) to their effects on specific plate tectonic locations. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<p>e. Interpret and explain how rock relationships and fossils are used to reconstruct the geologic history of the Earth. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>f. Apply principles of relative age (e.g., superposition, original horizontality, crosscutting relations, and original lateral continuity) to support an opinion related to Earth's geological history. (DOK 3)</p> <ul style="list-style-type: none"> <li>• Types of unconformity (e.g., disconformity, angular unconformity, nonconformity)</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Geological timetable</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>g. Apply the principle of uniformitarianism to relate sedimentary rock associations and their fossils to the environments in which the rocks were deposited. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>h. Compare and contrast the relative and absolute dating methods (e.g., the principle of fossil succession, radiometric dating, and paleomagnetism) for determining the age of the Earth. (DOK 1)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p><b>4. Demonstrate an understanding of Earth systems relating to weather and climate.</b></p>	

<p>a. Explain the interaction of Earth Systems that affect weather and climate. (DOK 1)</p> <ul style="list-style-type: none"> <li>• Latitudinal variations in solar heating</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• The effects of Coriolis forces on ocean currents, cyclones, anticyclones, ocean currents, topography, and air masses (e.g., warm fronts, cold fronts, stationary fronts, and occluded fronts)</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>b. Interpret the patterns in temperature and precipitation that produce the climate regions on Earth and relate them to the hazards associated with extreme weather events and climate change (e.g., hurricanes, tornadoes, El Niño/La Niña, global warming). (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>c. Justify how changes in global climate and variation in Earth/Sun relationships contribute to natural and anthropogenic (human-caused) modification of atmospheric composition. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Summarize how past and present actions of ice, wind, and water contributed to the types and distributions of erosional and depositional features in landscapes. (DOK 1)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Explain the thermodynamics associated with physical and chemical concepts related to temperature, entropy, enthalpy, and heat energy. (DOK 2)</p> <ul style="list-style-type: none"> <li>• Specific heat as it relates to the conservation of energy</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<p>e. Research and explain how external forces affect Earth's topography. (DOK 2)</p> <ul style="list-style-type: none"> <li>• How surface water and groundwater act as the major agents of physical and chemical weathering</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• How soil results from weathering and biological processes</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Processes and hazards associated with both sudden and gradual mass wasting</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p><b>5. Apply an understanding of ecological factors to explain relationships between Earth systems.</b></p>	
<p>a. Draw conclusions about how life on Earth shapes Earth systems and responds to the interaction of Earth systems (lithosphere, hydrosphere, atmosphere, and biosphere). (DOK 3)</p> <ul style="list-style-type: none"> <li>• Nature and distribution of life on Earth, including humans, to the chemistry and availability of water</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Distribution of biomes (e.g., terrestrial, freshwater, and marine) to climate regions through time</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

<ul style="list-style-type: none"> <li>• Geochemical and ecological processes (e.g., rock, hydrologic, carbon, nitrogen) that interact through time to cycle matter and energy, and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion, damming and channeling of rivers)</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>b. Interpret the record of shared ancestry (fossils), evolution, and extinction as related to natural selection. (DOK 2)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>c. Identify the cause and effect relationships of the evolutionary innovations that most profoundly shaped Earth systems. (DOK 1)</p> <ul style="list-style-type: none"> <li>• Photosynthesis and the atmosphere</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Multicellular animals and marine environments</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<ul style="list-style-type: none"> <li>• Land plants and terrestrial environments</li> </ul>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>
<p>d. Cite evidence about how dramatic changes in Earth's atmosphere influenced the evolution of life. (DOK 1)</p>	<p><b>Student Edition:</b></p> <p><b>Teacher Wraparound Edition:</b></p>

