

**Science**  
**Grade-Level Expectations: Earth Science**  
**(Recommended for Grades 11–12)**

**Science as Inquiry**

**The Abilities Necessary to Do Scientific Inquiry**

1. Write a testable question or hypothesis when given a topic (SI-H-A1)
2. Describe how investigations can be observation, description, literature survey, classification, or experimentation (SI-H-A2)
3. Plan and record step-by-step procedures for a valid investigation, select equipment and materials, and identify variables and controls (SI-H-A2)
4. Conduct an investigation that includes multiple trials and record, organize, and display data appropriately (SI-H-A2)
5. Utilize mathematics, organizational tools, and graphing skills to solve problems (SI-H-A3)
6. Use technology when appropriate to enhance laboratory investigations and presentations of findings (SI-H-A3)
7. Choose appropriate models to explain scientific knowledge or experimental results (e.g., objects, mathematical relationships, plans, schemes, examples, role-playing, computer simulations) (SI-H-A4)
8. Give an example of how new scientific data can cause an existing scientific explanation to be supported, revised, or rejected (SI-H-A5)
9. Write and defend a conclusion based on logical analysis of experimental data (SI-H-A6) (SI-H-A2)
10. Given a description of an experiment, identify appropriate safety measures (SI-H-A7)

**Understanding Scientific Inquiry**

11. Evaluate selected theories based on supporting scientific evidence (SI-H-B1)
12. Cite evidence that scientific investigations are conducted for many different reasons (SI-H-B2)
13. Identify scientific evidence that has caused modifications in previously accepted theories (SI-H-B2)
14. Cite examples of scientific advances and emerging technologies and how they affect society (e.g., MRI, DNA in forensics) (SI-H-B3)
15. Analyze the conclusion from an investigation by using data to determine its validity (SI-H-B4)
16. Use the following rules of evidence to examine experimental results:
  - (a) Can an expert's technique or theory be tested, has it been tested, or is it simply a subjective, conclusive approach that cannot be reasonably assessed for reliability?
  - (b) Has the technique or theory been subjected to peer review and publication?
  - (c) What is the known or potential rate of error of the technique or theory when applied?
  - (d) Were standards and controls applied and maintained?
  - (e) Has the technique or theory been generally accepted in the scientific community? (SI-H-B5) (SI-H-B1) (SI-H-B4)

**Earth and Space Science**

**Energy in Earth's System**

1. Describe what happens to the solar energy received by Earth every day (ESS-H-A1)
2. Trace the flow of heat energy through the processes in the water cycle (ESS-H-A1)
3. Describe the effect of natural insulation on energy transfer in a closed system (ESS-H-A1)

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4. Describe the relationship between seasonal changes in the angle of incoming solar radiation and its consequences to Earth's temperature (e.g., direct vs. slanted rays) (ESS-H-A2)
5. Explain how the process of fusion inside the Sun provides the external heat source for Earth (ESS-H-A3)
6. Discuss how heat energy is generated at the inner core-outer core boundary (ESS-H-A4)
7. Analyze how radiant heat from the Sun is absorbed and transmitted by several different earth materials (ESS-H-A5)
8. Explain why weather only occurs in the tropospheric layer of Earth's atmosphere (ESS-H-A5)
9. Compare the structure, composition, and function of the layers of Earth's atmosphere (ESS-H-A6)
10. Analyze the mechanisms that drive weather and climate patterns and relate them to the three methods of heat transfer (ESS-H-A6)
11. Describe the processes that drive lithospheric plate movements (i.e., radioactive decay, friction, convection) (ESS-H-A7) (ESS-H-A3) (ESS-H-A4)
12. Relate lithospheric plate movements to the occurrences of earthquakes, volcanoes, mid-ocean ridge systems, and off-shore trenches found on Earth (ESS-H-A7)

**Geochemical Cycles**

13. Explain how stable elements and atoms are recycled during natural geologic processes (ESS-H-B1)
14. Compare the conditions of mineral formation with weathering resistance at Earth's surface (ESS-H-B1)
15. Identify the sun-driven processes that move substances at or near Earth's surface (ESS-H-B2)

**The Origin and Evolution of the Earth System**

16. Use the nebular hypothesis to explain the formation of a solar system (ESS-H-C1)
17. Determine the relative ages of rock layers in a geologic profile or cross section (ESS-H-C2)
18. Use data from radioactive dating techniques to estimate the age of earth materials (ESS-H-C2)
19. Interpret geological maps of Louisiana to describe the state's geologic history (ESS-H-C3)
20. Determine the chronological order of the five most recent major lobes of the Mississippi River delta in Louisiana (ESS-H-C3)
21. Use fossil records to explain changes in the concentration of atmospheric oxygen over time (ESS-H-C4)
22. Analyze data related to a variety of natural processes to determine the time frame of the changes involved (e.g., formation of sedimentary rock layers, deposition of ash layers, fossilization of plant or animal species) (ESS-H-C5)

**The Origin and Evolution of the Universe**

23. Identify the evidence that supports the big bang theory (ESS-H-D1)
24. Describe the organization of the known universe (ESS-H-D2)
25. Using the surface temperature and absolute magnitude data of a selected star, locate its placement on the Hertzsprung-Russell diagram and infer its color, size, and life stage (ESS-H-D3)

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26. Identify the elements present in selected stars, given spectrograms of known elements and those of the selected stars (ESS-H-D4)
27. Trace the movement and behavior of hydrogen atoms during the process of fusion as it occurs in stars like the Sun (ESS-H-D5)
28. Identify the relationship between orbital velocity and orbital diameter (ESS-H-D6) (PS-H-E2)
29. Demonstrate the elliptical shape of Earth's orbit and describe how the point of orbital focus changes during the year (ESS-H-D6)
30. Summarize how current technology has directly affected our knowledge of the universe (ESS-H-D7)