Tennessee Science

Geology: Grades 9, 10, 11, 12

Adopted 2016

Earth's Place in the Universe GEO.ESS1

1. **Compare and contrast methods for constructing accounts of Earth's formation, early history, and/or changes in environmental conditions on Earth over time.** GEO.ESS1.1
2. **Evaluate evidence used to explain the ongoing changes in the Earth's system over geologic time due to interactions among the solid Earth, hydrosphere, and atmosphere.** GEO.ESS1.2
3. **Evaluate the geologic evidence (including index fossils, absolute and relative dating methods, superposition, and/or crosscutting relationships) used to infer the age of the Earth. Design a research study to confirm or refute one aspect of such evidence.** GEO.ESS1.3

Earth's Systems GEO.ESS2

1. **Analyze surface features of Earth in order to identify geologic processes (including weathering, erosion, deposition, and glaciation) that are likely to have been responsible for their formation.** GEO.ESS2.1
2. **Engage in an argument from geoscience data to assert that changes to Earth's surface can create feedbacks that cause changes to other Earth systems.** GEO.ESS2.2
3. **Create a visual model describing the processes responsible for forming the three rock groups (sedimentary, igneous, and metamorphic) and explaining their characteristics.** GEO.ESS2.3
4. **Classify minerals and rocks on the basis of their physical and chemical properties and the environment in which they were formed.** GEO.ESS2.4
5. **Distinguish between the physical and chemical properties of minerals.** GEO.ESS2.5
6. **Investigate the structure and geometry of crystals.** GEO.ESS2.6
7. **Communicate scientific and technical information about how the dynamic nature of the rock cycle accounts for the interrelationships among rock and mineral types, and describe how the total amount of material stays the same throughout formation, weathering, sedimentation, and reformation.** GEO.ESS2.7

8. **Develop a visual model to illustrate the formation and reformation of rocks over time including processes such as weathering, sedimentation, and plate movement. The model should include a comparison of the physical properties of various rock types, common rock-forming minerals, and continental rocks versus the oceanic crust.** GEO.ESS2.8

9. **Develop a model that combines the rock cycle and the carbon cycle, which explains what leads up to and follows a major volcanic eruption and its effect on carbon storage and fluxes.** GEO.ESS2.9

10. **Conduct research, provide a rationale, plan, and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. The rationale should take into account processes of the hydrologic cycle, including evaporation, condensation, precipitation, surface runoff, and groundwater percolation, infiltration, and transpiration.** GEO.ESS2.10

11. **Design a solution to a complex real-world problem caused by the dynamic nature of rivers and streams which erode and transport sediment, change their course, and flood their banks in natural and recurring patterns.** GEO.ESS2.11

12. **Obtain, evaluate, and communicate information about man-made and natural threats (e.g., mining, pollution, erosion, runoff, floods, and earthquakes) to Tennessee watersheds.** GEO.ESS2.12

13. **Communicate scientific and technical information to explain how evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle, and crust.** GEO.ESS2.13

14. **Apply scientific principles regarding thermal convection and gravitational movement of dense materials to predict the outcomes of continued development and movement of lithospheric plates from their growing margins at a divergent boundary (mid-ocean ridge) to their destructive margin at a convergent boundary (subduction zone).** GEO.ESS2.14

15. **Using maps and other data types, predict how plate tectonics cause earthquake activity, volcanic eruptions, and mountain building.** GEO.ESS2.15

16. **Analyze the effect of an earthquake upon the geosphere, hydrosphere, atmosphere, and/or biosphere, including sphere-to-sphere interactions. Analysis should conclude with an identification of future research to improve our ability to predict such interactions.** GEO.ESS2.16

Earth and Human Activity GEO.ESS3

1. **Use a topographic map and a geologic map to determine an ideal location for a Tennessee electricity-generating facility to provide solar, wind, nuclear, hydroelectric, or other renewable/nonrenewable power.** GEO.ESS3.1

2. **Make and defend a claim based on evidence to describe the formation and future availability of mined resources (e.g., phosphorous, platinum, and fossil fuels).** GEO.ESS3.2

3. **Evaluate the evidence and reasoning supporting claims about the impact of human activities on groundwater quality. The evaluation should include data related to multiple factors (e.g., precipitation, topography, porosity, and run-off).** GEO.ESS3.3

4. **Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources in areas where they are scarce. Compare solutions in terms of environmental impact, sustainability, and cost.** GEO.ESS3.4

Links Among Engineering, Technology, Science, and Society GEO.ETS2

1. **Read, interpret, and analyze a combination of ground-based observations, satellite data, and computer models to demonstrate the interconnectedness of the geosphere, atmosphere, hydrosphere, and biosphere.** GEO.ETS2.1

2. **Design, build, and refine a device to reduce or eliminate the effect of weathering, erosion, deposition, or other land-surface changes that could be used by the Army Corps of Engineers, Tennessee Valley Authority, Department of Highways, or other agency to improve the road or water systems in Tennessee.** GEO.ETS2.2

3. **Plan and carry out an investigation using a computer-based geographical information tool such as Google Earth, ArcGIS, or My NASA Data to examine the impact of human activities on Earth's surface features.** GEO.ETS2.3