**Earth**

**Science**

**Observation for Continued Assessment and End of the Year Evaluation**

This document is designed to assist in monitoring an individual student’s progress throughout the school year. The 2010 Science Virginia Standards of Learning Curriculum Framework establishes the foundation for the knowledge and skills each student should acquire.

Seven spaces are provided by each skill within this document for recording a student’s proficiency level (score of 4, 3, 2, or 1). The Comments section, after each standard, allows the teacher to provide specific information on observations, areas of strength, areas needing additional instruction, and a suggested plan for increasing student performance.

Student work, conversations with the student and observations provide evidence for the evaluation of performance. Evaluations are based on the student’s ability to explain, model, and apply learning.

This document is a fillable Word document. Complete the information on page 1 (below) and then click File, Save As the student's last name first initial and grade level. When entering a student's proficiency score on the appropriate line next to an SOL, click on the line and type the appropriate score number. When adding additional scores throughout the year/course, simply click onto the subsequent line and type the score number. Successive changes require a File, Save to ensure updates are properly recorded.

Student Name:

ID #:

School:

Teacher:

School Year:

**Modified and created by Dr. Dan Mulligan**

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**Scoring Rubric - Proficiency Levels**

* exhibits minimal performance
* shows very limited evidence of conceptual understanding and use of strategies
* responds with inappropriate answer and/or procedure frequently
* very often displays misunderstandings
* completes task appropriately and accurately infrequently
* needs assistance, guidance and modified instruction

Limited Proficiency (1)

* exhibits inconsistent performance and misunderstandings at times
* shows some evidence of conceptual understanding
* has difficulty applying strategies or completing tasks in unfamiliar situations
* responds with appropriate answer or procedure sometimes
* requires teacher guidance frequently
* needs additional time, opportunities
* demonstrates some proficient competencies but is inconsistent

Not Yet Proficient (2)

* exhibits consistent performance
* shows conceptual understanding
* applies strategies in most situations
* responds with appropriate answer or procedure
* completes task accurately; needs minimal assistance
* exhibits fluency and applies learning
* shows some flexibility in thinking
* works in confidence
* recognizes cause and effect relationships; applies models, and explains concepts

Proficient (3)

* consistent performance beyond grade level
* works independently; shows confidence and initiative
* understands advanced concepts
* applies strategies creatively
* analyzes and synthesizes
* justifies and elaborates responses
* makes critical judgments
* makes application and extensions beyond grade level; exceeds Proficient competencies in more challenging situations

Exceeds Expected Proficiency (4)

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| **Earth Science** |
|  | **ES.1 Overall Score** |
|                                                 | a. Measure mass and volume of regular and irregular shaped objects and materials using common laboratory tools, including metric scales and graduated cylinders |
|                                                 | b. Apply the concept of mass per unit volume and calculate density without being given a formula |
|                                                 | c. Record data in systematic, properly-labeled, multicell tables, and using data, construct and interpret continuous line graphs, frequency distributions, bar graphs, and other explicating graphics that present a range of parameters, relationships, and pathways |
|                                                 | d. Interpret data from a grph or table that shows changes in temperature or pressure with depth or altitude |
|                                                 | e. Interpret landforms, water features, map scale, horizontal distance between points, elevation and elevation changes, latitude and longitude, human-made structures and other pertinent features on 7.5 minute quadrangles on topographic maps  |
|                                                 | f. Construct profiles from topographic contours  |
|                                                 | g. Use latitude and longitude down to minutes, with correct north-south and east-west designations, to locate points on a map |
| Comments |

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|  | **ES.2 Overall Score** |
|                                                 | a. Analyze how natural processes explain multiple aspects of Earth systems and their interactions (e.g., storms, earthquakes, volcanic eruptions, floods, climate, mountain chains and landforms, geological formations and stratigraphy, fossils) can be used to make predictions of future interactions and allow scientific explanations for what has happened in the past |
|                                                 | b. Make predictions, using scientific data and data analysis |
|                                                 | c. Use data to support or reject a hypothesis |
|                                                 | d. Differentiate between systematically-obtained, verifiable data and unfounded claims |
|                                                 | e. Evaluate statements to determine if systematic science is used correctly, consistently, thoroughly, and in the proper context  |
|                                                 | f. Distinguish between examples of observations and inferences  |
|                                                 | g. Explain how scientific methodology is used to support, refute, or improve scientific theories |
|                                                 | h. Contrast the formal, scientific use of the term “theory” with the everyday nontechnical usage of “theory”  |
|                                                 | i. Compare and contrast hypotheses, theories, and scientific laws. For example, students should be able to compare/contrast the Law of Superposition and the Theory of Plate Tectonics |
| Comments |

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|  | **ES.3 Overall Score** |
|                                                 | a. Analyze the role of 1) the position of Earth in the Solar System; 2) the size of Earth and sun; and 3) Earth’s axial tilt in affecting the evolution of the planet and life on the planet |
|                                                 | b. Analyze historical explanations for the origin of the moon  |
|                                                 | c. Create a model showing the position of Earth, the moon, and the resulting moon phases |
|                                                 | d. Explain why there is not a solar and lunar eclipse each month |
|                                                 | e. Create a model showing the position of Earth, moon, and sun during a solar and lunar eclipse  |
|                                                 | f. Differentiate between the inner (terrestrial) planets and the outer (gaseous) planets and their corresponding atmospheric characteristics  |
|                                                 | g. Compare and contrast the internal makeup of the four inner planets and explain why they vary so significantly |
|                                                 | h. Compare and contrast the atmospheres, planetary makeup, surface conditions, and rotation of the planets  |
|                                                 | i. Compare the classifications of the dwarf planet Pluto to the planets in relation to its orbit, and its similarity to other objects in the Kuiper Belt |
|                                                 | j. Compare and contrast the defining characteristics among moons, comets, meteoroids, and asteroids |
|                                                 | k. Compare and contrast the characteristics of Venus, Earth, Mercury, and Mars, and interpret various reasons why each planet has such characteristics  |
|                                                 | l. Predict what conditions we would need to have in place for another celestial object to support life  |
|                                                 | m. Compare the various types of evidence obtained from the Apollo moon landings and other lunar exploration and how this is used to inform thinking about the moon |
|                                                 | n. Analyze how the role of technology (Galileo’s telescope, Hubble telescope, planetary orbiters, landers/rovers) has contributed to social and scientific change and enlightenment  |
|                                                 | o. Create a timeline of key events I space exploration |
| Comments |

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|  | **ES.4 Overall Score** |
|                                                 | a. Analyze why certain common metallic elements (iron, aluminum, silicon) are rarely, if ever, found in the native state |
|                                                 | b. Analyze the distribution and persistence of minerals at or near Earth’s surface in terms of Earth’s general structure, plate tectonics, and chemical and physical weathering |
|                                                 | c. Analyze the relationship between the qualities of cleavage, fracture, and hardness and the molecular structure and chemistry of silicates, carbonates, and oxides |
|                                                 | d. Identify minerals by their physical properties, such as hardness, color, luster, and streak |
|                                                 | e. Recognize some major rock-forming minerals such as quartz, feldspar, calcite, and mica |
|                                                 | f. Recognize ore minerals including pyrite, magnetite, hematite, galena, graphite, and sulfur |
| Comments |

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|  | **ES.5 Overall Score** |
|                                                 | a. Comprehend and identify various igneous rock textural features and mineral components with a hand sample or by description, and analyze the significance of these features in terms of mode of origin and history |
|                                                 | b. Analyze and identify various sedimentary rocks in terms of mode of origin and history, using sedimentary features (grain size, texture, and composition) |
|                                                 | c. Analyze the major groups of metamorphic rocks for mineral composition and textural features and determine the potential parent rock and in terms of the rock cycle |
|                                                 | d. Analyze a sequence of rocks in terms of types, textures, composition, fossils, structural, and weathering features in order to infer the history of the sequence over time |
|                                                 | e. Integrate the rock cycle with Plate Tectonics Theory and determine how this is reflected in the geology of Virginia’s five physiographic provinces  |
|                                                 | f. Classify the following rock types as igneous, metamorphic, or sedimentary: pumice, obsidian, basalt, granite, sandstone, conglomerate, shale, limestone, slate, schist, gneiss, marble, and quartzite  |
|                                                 | g. Differentiate between clastic and non-clastic sedimentary rocks |
|                                                 | h. Compare and contrast distinguishing characteristics of the crystal structure and textures of extrusive and intrusive igneous rocks  |
|                                                 | i. Describe the structure of foliated and unfoliated metamorphic rocks |
| Comments |

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|  | **ES.6 Overall Score** |
|                                                 | a. Analyze the formation of fossil fuels in terms of the rock cycle and Plate Tectonics Theory, and relate the formation of fossil fuels to ancient biologic and atmospheric conditions and changes and locations within Virginia |
|                                                 | b. Analyze how Virginia’s production and use of various natural resources has changed over time. Define and cite differences over time especially in the last 50 years. |
|                                                 | c. Evaluate Virginia’s potential as a producer of renewable energy sources |
|                                                 | d. Assess the role of fossil fuels and renewable energy sources in the future and compare and contrast the environmental benefits and costs among the various options |
|                                                 | e. Analyze the advantages and disadvantages of various energy sources  |
|                                                 | f. Analyze a range of emerging energy and mineral resources in Virginia in terms of costs and benefits  |
|                                                 | g. Determine the sources of clean water in their community and analyze consumption and supply data |
| Comments |

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|  | **ES.7 Overall Score** |
|  | a. Label on a map the physiographic provinces of Virginia |
|                                                 | b. Comprehend the topographic, rock-type and geologic-structural characteristics of each physiographic province of Virginia |
|                                                 | c. Analyze the geologic history of Virginia in terms of the structures, rock types, and topography represented in the five physiographic provinces |
|                                                 | d. Integrate and interpret the rock cycle, plate tectonics, and Virginia’s geology in an interacting diagram |
|                                                 | e. Analyze how multiple continental collisions and rifting events over the last billion years have created the current physiography of Virginia  |
|                                                 | f. Comprehend and apply the details of Plate Tectonics Theory to the formation of continents, mountain chains, island arcs, deep open trenches, earthquake zones, and continental and mid-ocean volcanism  |
|                                                 | g. Analyze the composition and structure of the continental and oceanic lithosphere in terms of topographic features, density, thickness, and rates of motion |
|                                                 | h. Compare and contrast various types of volcanism and geothermal activity (i.e., Hawaii, Iceland, Mount St. Helens, Catoctin Greenstone, Tambora, the Deccan Traps, and Yellowstone)  |
|                                                 | i. Compare and contrast different types of current and ancient plate boundaries (i.e., Japan, California, New Madrid, Missouri, the Appalachian system, Iceland, and Tonga) |
|                                                 | j. Analyze how seismic waves provide evidence of the structure of the deep Earth including the inner and outer core in terms of composition, density, and viscosity |
|                                                 | k. Analyze the body of evidence for Plate Tectonics Theory (i.e., seafloor age, magnetic information, seismic profiles, laser-measured motion studies, fossil evidence, rock types associated with particular tectonic environments)  |
|                                                 | l. Analyze the various structures produced in convergent plate boundaries  |
|                                                 | m. Offer interpretations of the tectonic history of an area based on the range and type of rocks found in that area |
|                                                 | n. Compare and contrast the tectonic activity of the east coast and the west coast of North America  |
| Comments |

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|  | **ES.8 Overall Score** |
|                                                 | a. Interpret a simple groundwater diagram showing the zone of aeration, the zone of saturation, the water table, and an aquifer |
|                                                 | b. Interpret a simple hydrologic cycle diagram, including evaporation, condensation, precipitation, and runoff |
|                                                 | c. Locate the major Virginia watershed systems on a map (Chesapeake Bay, Gulf of Mexico, and North Carolina sounds) |
|                                                 | d. Analyze the formation of karst in terms of rock type, solubility and permeability, uplift, the water table, and chemical and physical weathering |
|                                                 | e. Analyze the presence of groundwater in various types of rock terrains, including areas found in each of the physiographic provinces of Virginia  |
|                                                 | f. Analyze the relationship between salt-water intrusion in the ground water in certain areas of eastern Virginia and buried crater structures  |
| Comments |
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|  | **ES.9 Overall Score** |
|                                                 | a. Describe how life has changed and become more complex over geologic time |
|                                                 | b. Interpret a simple geologic history diagram, using superposition and cross-cutting relations |
|                                                 | c. Analyze how radioactive decay provides a reliable method to determine the age of many types of organic and inorganic materials |
|                                                 | d. Analyze the impact and role of global catastrophes (including asteroid/comet impacts, volcanism, continental collisions, climate collapse) on extinctions and evolution |
|                                                 | e. Analyze and interpret complex cross sections using both relative and absolute dating to unravel and define the geologic history of the section |
| Comments |

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|  | **ES.10 Overall Score** |
|                                                 | a. Identify the effects of human activities on the oceans |
|                                                 | b. Analyze the potential impact of a major environmental disaster on the base of the food web and vertebrate organisms; economics; cultures; and future productivity |
|                                                 | c. Analyze the relationship between moving continents, the presence of ice caps, and ocean circulation over long periods of time |
|                                                 | d. Relate important ocean conditions, including El Nin᷉o, to weather on the continents |
|                                                 | e. Evaluate the role of the marine environment in the extraction of carbon dioxide in carbonates and the production of oxygen  |
|                                                 | f. Analyze the role of ocean currents in the distribution of heat from the equatorial regions to the poles, and predict what changes may occur as continents move and atmospheric conditions and climate vary  |
|                                                 | g. Compare Atlantic Ocean and Gulf of Mexico water temperatures during the yearly cycle, and relate this to the formation of storms |
|                                                 | h. Describe how different types of pollution can pollute the Chesapeake Bay even though the pollutant source may be hundreds of miles from the Bay  |
| Comments |
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|  | **ES.11 Overall Score** |
|                                                 | a. Analyze the array of climate feedback mechanisms that control the Earth’s temperature over time, and compare and contrast these feedback mechanisms to those operating on inner planets and the gas giants |
|                                                 | b. Analyze the evidence for atmospheric compositional change over geologic time including oxygen and carbon sinks and the role of photosynthetic organisms |
|                                                 | c. Explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth |
|                                                 | d. Explain how biologic activity, including human activities, may influence global temperature and climate |
| Comments |

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|  | **ES.12 Overall Score** |
|                                                 | a. Identify and describe the direction of local winds (land, sea breezes and jet stream) |
|                                                 | b. Read and interpret data from a thermometer, a barometer, and a physchrometer |
|                                                 | c. Predict weather based on cloud type, temperature, and barometric pressure |
|                                                 | d. Read and interpret a weather map containing fronts, isobars, and isotherms |
|                                                 | e. Read and interpret weather station models  |
|                                                 | f. Identify types and origins of air masses, fronts and the accompanying weather conditions  |
|                                                 | g. Read and interpret climate graphs |
|                                                 | h. Label a diagram of global climate zones and the surface movement of ocean currents  |
|                                                 | i. Label a diagram that demonstrates the interaction of earth’s atmosphere and energy transfer (conduction, convection, and radiation) |
|                                                 | j. Analyze the impact of satellite technology on weather prediction and the tracking of severe storms, including hurricanes, and evaluate the cost and benefits of this technology in terms of lives and property saved. Predict the impact on storm preparedness if there were no weather satellites |
| Comments |

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|  | **ES.13 Overall Score** |
|                                                 | a. Contrast the life span and energy output of a blue giant star to that of the sun and relate this to the potential existence of life on planets in its orbit |
|                                                 | b. Explain the potential origin and role of ultra massive black holes in the center of galaxies |
|                                                 | c. Using the Hertzsprung-Russell diagram, classify stars as to their place on the main sequence or in beginning or end points in their life cycles |
|                                                 | d. Evaluate the probability of travel to nearby solar systems using current spacecraft speeds |
|                                                 | e. Analyze the various fusion products of a blue giant star over its lifetime, and relate this to the presence and abundance of elements that make up our solar system and its contents, including living organisms  |
| Comments |