**2013 Mars Revealed Training Activities’**

**Alignment with the Next Generation Science Standards**

Is It Science?

**Nature of Science: Scientific Investigations Use a Variety of Methods**

* Scientific values function as criteria in distinguishing between science and non-science.
* Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings.

**Nature of Science: Scientific Knowledge is Based on Empirical Evidence**

* Science knowledge is based upon logical and conceptual connections between evidence and explanations.
* Science knowledge is based on empirical evidence.
* Science arguments are strengthened by multiple lines of evidence supporting a single explanation.

**Nature of Science: Scientific Knowledge is Open to Revision in Light of New Evidence**

* Scientific explanations are subject to revision and improvement in light of new evidence.
* Most scientific knowledge is quite durable but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence.

**Nature of Science: Science is a Way of Knowing**

* Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review.
* Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time.

**Nature of Science: Science Is a Human Endeavor**

* Scientific knowledge is a result of human endeavor, imagination, and creativity.

**Nature of Science: Science Addresses Questions About the Natural and Material World**

* Science limits its explanations to systems that lend themselves to observation and empirical evidence.
* Not all questions can be answered by science.

Blue Marble Matches

ESS2-2. Analyze and interpret data from maps to describe patterns of Earth’s features.

4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**Science and Engineering Practices: Analyzing and Interpreting Data**

* Analyze and interpret data to provide evidence for phenomena.
* Analyze and interpret data to determine similarities and differences in findings.
* Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.

Mars Mystery Rocks

HS-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.

**Disciplinary Core Ideas: PS4.C: Information Technologies and Instrumentation**

* Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.

**Disciplinary Core Ideas: PS4.B: Electromagnetic Radiation**

* When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light.

**Disciplinary Core Ideas: PS4.B Electromagnetic Radiation**

* Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.

**Nature of Science: Scientific Investigations Use a Variety of Methods**

* Science investigations use a variety of methods and tools to make measurements and observations.

**Science and Engineering Practices: Planning and Carrying Out Investigations**

* Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

**Science and Engineering Practices: Analyzing and Interpreting Data**

* Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
* Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
* Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

**Science and Engineering Practices: Using Mathematics and Computational Thinking**

* Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.

Cratering Boxes

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**Disciplinary Core Ideas ESS1.C: The History of Planet Earth**

* Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

**Disciplinary Core Ideas: PS3.A: Definitions of Energy**

* Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.

**Nature of Science: Scientific Investigations Use a Variety of Methods**

* Science investigations use a variety of methods and tools to make measurements and observations.

**Science and Engineering Practices: Developing and Using Models**

* Develop and/or use models to describe and/or predict phenomena.
* Evaluate limitations of a model for a proposed object or tool.

Online Impact Cratering Laboratory

**Nature of Science: Scientific Investigations Use a Variety of Methods**

* Science investigations use a variety of methods and tools to make measurements and observations.
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**Science and Engineering Practices: Analyzing and Interpreting Data**

* Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
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* Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

**Science and Engineering Practices: Using Mathematics and Computational Thinking**

* Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.

Strange New Planet

**Science and Engineering Practices: Asking Questions and Defining Problems**

* Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships

**Science and Engineering Practices: Planning and Carrying Out Investigations**

* Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

**Science and Engineering Practices: Constructing Explanations and Designing Solutions**

* Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

History of Mars Exploration

**Nature of Science: Scientific Investigations Use a Variety of Methods**

* New technologies advance scientific knowledge.
* Science investigations use a variety of methods and tools to make measurements and observations.

**Nature of Science: Scientific Knowledge is Based on Empirical Evidence**

* Science includes the process of coordinating patterns of evidence with current theory.
* Science arguments are strengthened by multiple lines of evidence supporting a single explanation.

**Nature of Science: Scientific Knowledge is Open to Revision in Light of New Evidence**

* Science findings are frequently revised and/or reinterpreted based on new evidence.

**Nature of Science: Science is a Human Endeavor**

* Technological advances have influenced the progress of science and science has influenced advances in technology.
* Science and engineering are influenced by society and society is influenced by science and engineering.

**Nature of Science: Science Addresses Questions About the Natural and Material World**

* Scientific knowledge is constrained by human capacity, technology, and materials.
* Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.

**Science and Engineering Practices: Asking Questions and Defining Problems**

* Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.

**Science and Engineering Practices: Analyzing and Interpreting Data**

* Analyze and interpret data to provide evidence for phenomena.
* Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
* Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

**Science and Engineering Practices: Constructing Explanations and Designing Solutions**

* Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.

**Science and Engineering Practices: Engaging in Argument from Evidence**

* Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Lava Layering

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**Disciplinary Core Ideas ESS1.C: The History of Planet Earth**

* The geologic time scale interpreted from rock strata provides a way to organize Earth’s history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.

**Science and Engineering Practices: Developing and Using Models**

* Develop and/or use models to describe and/or predict phenomena.

**Science and Engineering Practices: Planning and Carrying Out Investigations**

* Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

**Science and Engineering Practices: Analyzing and Interpreting Data**

* Analyze and interpret data to provide evidence for phenomena.
* Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
* Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

**Science and Engineering Practices: Constructing Explanations and Designing Solutions**

* Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

Stream Tables

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**Disciplinary Core Ideas ESS2.C: The Roles of Water in Earth’s Surface Processes**

* Water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations.

**Science and Engineering Practices: Developing and Using Models**

* Develop and/or use models to describe and/or predict phenomena.

Mars Meteorology

HS-ESS3-5. Analyze data using computational models in order to make valid and reliable scientific claims.

**Disciplinary Core Ideas ESS2.D: Weather and Climate**

* The foundation for Earth’s global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy’s re-radiation into space.

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**Science and Engineering Practices: Using Mathematics and Computational Thinking**

* Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.

Crater Comparisons

**Disciplinary Core Idea**

* ESS1C. History of Planet Earth

**Science and Engineering Practices**

* Practice 1: Asking Questions and Defining Problems
* Practice 3: Planning and Carrying Out Investigations
* Practice 4: Analyzing and Interpreting Data
* Practice 5: Using Mathematics and Computational Thinking
* Practice 6: Constructing Explanations and Designing Solutions
* Practice 7: Engaging in Argument from Evidence
* Practice 8: Obtaining, Evaluating, and Communicating Information

**Cross Cutting Concepts**

* 1. Patterns
* 2. Cause and Effect
* 3. Scale, Proportion, and Quantity
* 6. Structure and Function
* 7. Stability and Change

**Nature of Science**

* Scientific Investigations Use a Variety of Methods
* Scientific Knowledge is Based on Empirical Evidence
* Scientific Knowledge is Open to Revision in Light of New Evidence
* Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
* Science is a Way of Knowing
* Scientific Knowledge Assumes an Order and Consistency in Natural System
* Science is a Human Endeavor
* Science Addresses Questions about the Natural and Material World

Marsbound!

**Science and Engineering Practices: Asking Questions and Defining Problems**

* Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

**Science and Engineering Practices: Using Mathematics and Computational Thinking**

* Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.

**Science and Engineering Practices: Constructing Explanations and Designing Solutions**

* Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

**Nature of Science: Science Addresses Questions About the Natural and Material World**

* Scientific knowledge is constrained by human capacity, technology, and materials.
* Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.