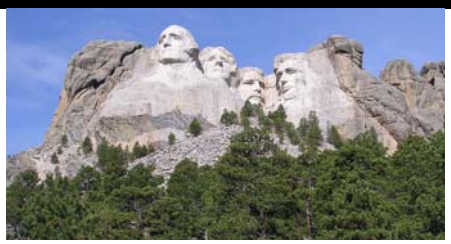

Mount Rushmore Education Program
Planning Worksheet

Instructor Name:_____

Title of Program:
Preservation at Mount Rushmore

Grade level: 6-8 **Subject area:** Geology/Physical Science

Content Standard: Science as Inquiry and Physical Science for 6th through 8th grades
-Standards: U.S. National Science Education Standards
-List Standards:

- U.S. National Science Education Standards for 5- 8

Science as Inquiry (8ASI): Ability necessary to do scientific inquiry

- (8ASI1.1) Identify questions that can be answered through scientific investigations. Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of students' ability to clarify questions and inquiries and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Students should develop the ability to identify their questions with scientific ideas, concepts, and quantitative relationships that guide investigation.
- (8ASI1.2) Design and conduct a scientific investigation. Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables. They should also develop the ability to clarify their ideas that are influencing and guiding the inquiry, and to understand how those ideas compare with current scientific knowledge. Students can learn to formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.
- (8ASI1.3) Use appropriate tools and techniques to gather, analyze, and interpret data. The use of tools and techniques, including mathematics, will be guided by the question asked and the investigations students design. The use of computers for the collection, summary, and display of evidence is part of this standard.
- (8ASI1.5) Think critically and logically to make the relationships between evidence and explanations. Thinking critically about evidence includes deciding what evidence should be used and accounting for anomalous data. Specifically, students should be able to review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment. Students should begin to state some explanations in terms of the relationship between two or more variables.
- (8ASI1.8) Use mathematics in all aspects of scientific inquiry. Mathematics is essential to asking and answering questions about the natural world. Mathematics can be used to ask questions; to gather, organize, and present data; and to structure convincing explanations.

Science as Inquiry (8ASI): Understandings About Scientific Inquiry

- (8ASI2.1) Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- (8ASI2.2) Current scientific knowledge and understanding guide scientific investigations. Different methods, core theories, and standards to advance scientific knowledge and understanding.
- (8ASI2.3) Mathematics is important in all aspects of scientific inquiry.
- (8ASI2.4) Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.
- (8ASI2.5) Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models and theories. The scientific community accepts and uses such explanations until displaced by better scientific ones. When such displacement occurs, science advances.

Physical Science (8BPS): Properties and changes of properties in matter

- (8BPS1.1) A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.

Lesson objectives: "The learner will be able to . . .

Learn about the various preservation concerns at Mount Rushmore. By learning to recognize the various types of rocks found in Mount Rushmore and their different characteristics and varying rates of erosion, students will be able to understand the complexity of caring for a monument like Mount Rushmore.

Introduction: What is the hook, the attention grabber, the interesting beginning?

Do rocks last forever? Structures made out of stone have proven to last a long time relative to a human lifespan, but they do age and erode over time. How do we study this? Do they all erode in a similar way/rate? Use provided images of erosion as visual aids.

Content: Body of lesson, sequence of learning activities.
(Keep them busy, keep them active, keep them thinking, keep them involved)
Best practices include interactive, interdisciplinary, inquiry based, hands-on, multi-sensory, engaging learning activities.
Activities might include listening, viewing, reading, writing, drawing, calculating, thinking, discussing, sharing, simulations, cooperative learning.

Move to a discussion of what a heritage site is. Introduce students to Mount Rushmore as an American heritage site and discuss how the sculptor, Gutzon Borglum, decided to carve the heads of the four Presidents. Show two pictures of Mount Rushmore: before and after carving. Help the students recognize that the change was brought about through the implementation of a human design. What we have as a result is a monumental sculpture that took a great amount of human and material resources. How do we make sure that we're taking care of an important heritage site like Mount

Rushmore when there are forces like deterioration and destruction at play? To illustrate deterioration, use provided sample photos of deteriorating structures. For destructions, use example of Bamiyan Buddhas that were destroyed by the Taliban in 2002. Begin looking closer at the sculpture by using the provided Measurable 3D PDF of the model, or the 3D viewer on the CyArk website. In both the 3D PDF and online 3D Viewer, the teacher can cut sections through the model to better illustrate the complexity of the mountain's contours.

Use the PDF entitled "Caring for a Monumental Sculpture" to introduce the students to the specific preservation concerns at Mount Rushmore. Learn about rock blocks and how they can help us determine how the Sculpture could potentially fail/collapse. Brainstorm on what some of the culprits are for erosion and movement. Water and temperature change are two of the most major culprits.

Hands-on activity 1: Learn about the various types of rocks found in Mount Rushmore. Use the provided photos to do a general mapping of the different types of rock veining over the provided blank illustration of Mount Rushmore.

Hands-on activity 2: This activity is to demonstrate the effects of erosion and seeing how different types of one material can erode at different rates. As a demonstration, test the erosion of different types of soap in the classroom by implementing a schedule of repeated washing. Students should collect and organize measurement data collected at the appropriate intervals. Show photographs of cap rocks exemplify stones of differing composition eroding at different rates.

Hands-on activity 3: This activity is to demonstrate how the freezing/thawing of water absorbed by a material can cause changes in the material itself. To test thawing/melting, conduct an experiment by soaking a sponge in water then freezing it and comparing before/after measurements. Let the sponge thaw and collect measurement data again. In rocks, this freezing/thawing cycle could cause cracking to occur since rocks do not readily expand and contract.

Optional activity: To reinforce the concept from the above activity, students can conduct another experiment using materials like chalk or pumice stone, and soaking them in water (note that with pumice stone, students may need to wait up to a day for the rock to absorb all the water it can hold). Students should collect measurement data at appropriate time intervals (every 15-30 minutes of soaking until rock ceases to increase in weight) and use this data to calculate the change in the volume of the rock.

Materials needed: (equipment, handouts, graphic organizer, worksheets, props, papers)

-Computer for introduction presentation and any necessary research
-Photos of Mount Rushmore, before and after carving (provided)
-Illustrative images of deterioration and destruction (provided)
-Measurable 3D PDF of the mountain (provided—Teacher should spend some time becoming familiar with this file's use ahead of time)
-PDF document entitled: Caring for a Monumental Sculpture (provided)
-PDF entitled: Erosion Rates (provided); a fact sheet about different types of rocks and their erosion rates
-Photographs of the sculpture to aid in mapping activity (provided)
-PDF of blank illustration of the sculpture for mapping activity (provided)

-Photos of cap rock (as example of two types of sandstone eroding at different rates)
-Blank forms to record experiment observations
-Calculators
-Rulers
-Soaps of varying hardness
-Access to a sink
-Sponges
-Access to a freezer
-Chalk or pumice stone
-Cups to hold chalk or pumice stone
-Water
-Scale

Summary and conclusion of lesson: What helps set a course of action or leaves them thinking?

Summarize concepts covered through activities.

Theme statement: (The "big picture", the final result, the "so what?!)

Do rocks last forever? Even rocks are not immune to deterioration and damage. External forces can erode rocks. Water might seem like a harmless material (even beneficial, in fact), but it can be a vicious enemy for a sculpture like Mount Rushmore or other structures. We discussed water and temperature as common culprits in erosion, but there are many more.

Evaluation method: How will we see the success of your program?
Example: completed worksheets, class discussion, drawings

Evaluate student involvement and results of in-class activity.

Optional take-home activity: Find a building/structure in your local town where you can see the decay/erosion. Depending on the materials and age of the structure, the characteristics of the decay/erosion will be different. Take a picture and share it with the class, along with a hypothesis of what caused the effects that you are seeing. Example locations: historic downtown, cemetery, etc.