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Geology: Just Touching the Surface [4th grade]

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Understanding by Design Curriculum Units

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Geology: Just Touching the Surface

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Unit Cover Page

Unit Title: Geology: Just Touching the Surface

Grade Level: 4

Subject/Topic Area(s): Earth Science (Geology)

Designed By: Michael Shay & Carrie Susong

Time Frame: 23 days

School District (One Designer):

School:

School Address and Phone:

Brief Summary of Unit (Including curricular context and unit goals):

In this unit, students will explore patterns of change in the earth's layers through hands-on experiments and activities, as well as case studies of geologic phenomena. Students will learn about volcano types, volcanic activity, and plate movement and its effects. Students will be exposed to the plate tectonic theory and its implications on geologic history. They will observe the effects of geologic activity on human life based through case studies such as Mt. St. Helens, the 1989 earthquake in Loma Prieta, California, and the tsunami of 2004. Students will also gain new perspective on the decisions humans make in their choice of location. Why do people live near potentially harmful landmarks? What are the benefits associated with living near a volcano or fault line? Students will demonstrate their understanding of these questions through diary entries and class discussions. Students will also learn about how mountains are formed and will classify mountain types based on their appearance. Throughout the unit, students will examine models of the earth as well as models of geologic phenomena. They will observe how the models represent real-world situations, and will also identify limitations of each model.

Throughout each portion of the unit, students will connect patterns of change to geologic phenomena, in order to hypothesize what the earth was like in the past, as well as to predict what geologic phenomena might occur in the future. By practicing such skills, students will see the importance of scientific study to the well-being of life on earth.

The unit will conclude with a performance task that, upon giving students scientific data (seismic readings, temperature readings, relief maps, and pictures of the landmark), asks them to identify the geologic landmark of a hypothetical area. Students must then identify potential benefits and dangers of living near the landmark, possible events that have occurred in the area's recent history, and possible events that may occur in the future. Students will gather their findings and prepare a pamphlet to present to a small audience. By using their knowledge in a practical way, students will enjoy a memorable and intellectually rewarding activity.

Content Standard(s)

4.6 The student knows that change can create recognizable patterns.

a. The student is expected to identify patterns of change.

4.10 The student knows that certain past events affect present and future events.

a. The student is expected to identify and observe effects of events that require time for changes to be noticeable.

4.3 The student uses critical thinking and scientific problem solving to make informed decisions.

a. The student is expected to analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.

c. represent the natural world using models and identify their limitations.

d. evaluate the impact of research on scientific thought, society, and the environment.

4.2 The student uses scientific inquiry methods during field and laboratory investigations.

c. The student is expected to analyze and interpret information to construct reasonable explanations from direct and indirect evidence.

d. communicate valid conclusions.

e. construct simple graphs, tables, maps, and charts to organize, examine, and evaluate information.

Core Knowledge Grade 4 Science: Geology

A. The Earth's Layers

B. How Mountains are Formed

STAGE 1 – DESIRED RESULTS

Essential Question(s)

How and why does the earth change? Why is it important for us to know?

How do know what the earth was like in the past? How do we predict what it will be like in the future?

Understanding(s) Students will understand that…

Patterns of change in the earth's layers help explain what happened and help to predict future changes.
The plate tectonic theory helps us to explain and interpret geologic phenomena (volcanoes, earthquakes, etc.)
Layers of the earth interact with each other in a way that supports the law of matter.
Humans are affected by changes on the earth's surface, in both positive and negative ways.

Students will know…

- Key terms—magma, ash, lava, lava flow, hot spring, geyser, earthquake, tsunami, seismograph, continental plate
- 4 volcano types and the volcanic activity associated with each
- 4 mountain types and how they are formed
- 3 types of plate movement and their effects
- positive and negative effects of plate movement, including the effects of volcanic and earthquake activity

Students will be able to: **K**

- interpret seismic and temperature readings to determine what happened in a given area
- classify landforms based upon their appearance
- compare positive and negative effects of a landform
- predict future geologic activity in a given area
- justify explanations with geologic evidence

STAGE 2 – ASSESSMENT EVIDENCE

Performance Task T

You are a scientist working on a continent that has just been discovered. You have been asked by city builders in a nearby area to investigate its geologic history before they start construction. This place has an important geologic landmark. You have been given seismic readings, temperature readings, relief maps, and pictures of the area. Your task is to determine what the landmark is and to make a prediction about what could happen to the area in the future. You should also explain to the builders the benefits and dangers of building and living in this area.

Key Criteria:

You must present your findings by creating a pamphlet that interprets the seismic and temperature readings, explains relief maps and pictures to identify the landform, explains the reason for previous geologic activity and what happened, compares positive and negative effects of the landform, and predicts future geologic activity. As an extension, you may propose plans to ensure public safety. You will show your pamphlet to a small audience of peers and justify your decisions.

Other Evidence

Quiz/Prompt on layers & volcanic activity
Quiz/Prompt on earthquakes & plate tectonics
Quiz on mountains
Performance task
Performance task self-assessment

Stage 3 – Learning Plan

(Each day's lesson is designed to be 45 minutes in length.)

1. **Day One:** Tell the story about Lake Nyos to hook students into thinking about reasons to explain volcanoes. Why do we need to learn about volcanoes? How do we do that? **H**
2. Introduce the essential questions and give an overview of the performance task. Assign KWL chart for homework (students fill out K and W, and will fill out the L throughout the unit.) **W**
3. **Day Two:** (Key vocabulary terms are introduced and recorded as needed throughout the unit.) Present students with a case study of Mt. St. Helens eruption of 1980. Have students make hypotheses about what caused certain events in the eruption. Students share hypotheses, leading to class discussion with additional visuals of Mt. St. Helens. **HER**
4. **Day Three:** Introduce volcano types: dome volcano, composite volcano, shield volcano, lava dome. Show video: "Volcanoes: Fire from Within" with worksheet to define volcano types, magma, ash, lava, lava flow, igneous, & metamorphic rocks. Follow with discussion and song. HW: Label volcano diagram. **ET**
5. **Days Four and Five:** Introduce hot springs and geysers as other types of volcanic activity, using soda bottle demonstration. Introduce chart. **HE**
6. Revisit examples of volcanic activity as presented in the past week. Show pictures of examples and show video: "Volcanoes". Have students examine positive and negative effects that these examples have had on people and other living things using a chart. Students will choose an example and create a magazine ad for the landmark explaining its positive and/or negative aspects. **ERT**
7. **Day Six:** Show students temperature readings of soil from outside; lava and areas around volcanoes; hot spring water; geyser steam. (Explain boiling point, compare temperatures.) Ask, why are these temperatures so high? What does that tell us about the earth? Have students make a sketch of what they think the earth looks like from a cross-section point of view. **HE**
8. **Day Seven:** Students perform peach experiment to learn about layers of the earth. Students make analogy of peach and earth; identify the model's similarities and limitations. Draw diagram about layers to take home. **HR**
9. **Day Eight:** Give quiz on earth's layers and volcanic activity (includes academic prompt about Paricutin and layer analogy). **E-2**
10. **Day Nine:** Present students with a case study of Loma Prieta earthquake of 1989. Have students answer the question, Is there any way we could have known this was going to happen? What could we do to prepare for something like this in the future? **HER**
11. Present students with information about the tsunami of 2004. Compare effects of tsunami and earthquake. Have students choose between earthquake and tsunami, and write a diary entry from the perspective of a child experiencing one of these events. **HER**
12. **Day Ten:** Introduce seismograph as instrument for measuring earthquake activity. Perform seismograph activity and discuss. Have students create their own graph of seismic readings. **ET**
13. **Day Eleven:** Show students map of seismic activity around the world. Connect dots of epicenters around the world to create plates. Perform egg demonstration. Define plates and explain why they move. **E**
14. **Day Twelve:** Perform graham cracker demonstrations of 3 different plate movements. Show map of plate movement around the world. During demonstration, students discuss what happened to the plates. Show picture of an example of plate movement before each graham cracker demonstration. Students fill out chart explaining plate movement, location, result, and diagram. Students show movements with their hands during each step of the demonstration. Oral assessment with the class concludes the lesson. **ERT**
15. **Day Thirteen:** Give quiz on earthquakes and plate tectonics (includes academic prompt about plate movement scenario). **E-2**

16. **Day Fourteen:** Connect plate movements to mountain formations. Students (in groups) perform an inductive sorting activity using pictures, drawings, and relief maps of 4 types of mountains. Groups share their classifications with the class. **HER**
17. Present 4 types of mountains using pictures, drawings, and relief maps. Have students revise their classifications. Students perform interpretive body movements to demonstrate mountain types. **RT**
18. **Day Fifteen:** Discuss major mountain ranges of the world. Show video. Connect to world map of fault movements. **E**
19. **Day Sixteen:** Present facts on continental plate movement. Perform demonstration on time sequence for plate movement. **ET**
20. **Day Seventeen:** Perform hypothetical activity with puzzle pieces representing continental plates. Students hypothesize where plates might have been millions of years ago, where they might be in a million years. Share hypotheses in groups. Introduce continental drift and Pangaea. **HER**
21. **Day Eighteen:** Give quiz on mountains and continental drift. **E-2**
22. **Days Nineteen-Twenty-Two:** Introduce performance task, with expectations, rubric, and allowable materials. Show teacher-created example. Students work independently to create pamphlet. **WR**
23. **Day Twenty-Three:** Students present their pamphlets to small groups of peers and adult. Students answer questions about their project and complete self assessment on performance task and the unit. **E-2**