Lesson 1

Web Quest

Created By: Lauren Huntington

Volcanoes/Earth Science/7th Grade

Lesson Overview:

This lesson is intended to be the introductory lesson in a volcano unit. The students build their independent learning skills, as well as knowledge on volcanoes by performing a web quest using provided links and simulations to research and answer specific questions regarding volcano, magma, eruption and rock types, locations, and volcanic features. The lesson opens with a pre-assessment journal entry and discussion about volcanoes. This lesson is written to students in Wyoming, where Yellowstone is a common theme.

Duration: 2 50 minute class periods

Objectives:

Students will be able to describe what volcanos are and why they occur.
Students will be able to locate where volcanoes occur on Earth
Students will be able to differentiate between the different types of volcanoes that occur on Earth.

NGSS Standards Addressed:

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

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

MS.Earth's Systems
MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Materials:

Students will need access to the internet via personal computers or tablets.
The web quest and links to follow will be available on the classes' google classroom and also printed and handed out. (It is easier to follow links if the web quest is available through an online format), but the questions should be answered on a hard copy.

5E's

- **Engagement**

Students are engaged during the class opener by writing a paragraph about their personal experiences with volcanoes: Seeing them in movies, on the news, visiting them, reading about them. Anything that gives them a personal connection to the topic can be written in a journal. Students will then share their experiences during a teacher-facilitated class discussion.

The teacher will provide the writing prompt for all students to see upon entering class. It can be written on the whiteboard, or projected on a screen. The prompt is "Write a paragraph describing what you know about volcanoes and what personal experiences you might have with them. Think about volcanoes you may have seen in movies, on the news, read about, or possibly visited. Be prepared to discuss."

Students will have 5-10 minutes to write their paragraphs, then the teacher will lead a discussion, starting with asking who wants to share what they wrote about.

Possible facilitating discussion questions:

Has anybody ever visited an active volcano? What does it look like?
Do all volcanos look the same? What do they look like?
When you think of a volcano erupting, what do you think it looks like?
Do all volcanoes have large, hazardous eruptions?

The discussion should lead students to realize that volcanoes aren't just steep mountainous structures that shoot magma out of the top, and there is a lot to explore regarding volcanoes.

- **Exploration:**

Students will be visiting multiple volcano simulations online as they are guided through answering questions on a web quest (handout #1 in instructional materials). Students will be allowed to work in pairs, but each student must individually answer the questions.

To ensure students remain on task during their online volcano exploration, the teacher will refocus the students every 10 minutes by asking if the students to share something that they've discovered that they found interesting. The students may also need clarification questions answered at these intervals. If students have questions about vocabulary, write the word and definition on the board.

- **Explanation:**

Once the students finish their web quests and have turned them in, the class will once again have a discussion. Students will revisit their journal entries about volcanoes, and with a partner discuss what they wrote about volcanoes, compared to what they know now. They will also discuss what they learned from the web quest that they felt was the most interesting or surprising. They will then share with the class during the discussion.

The teacher will facilitate the discussion, by first asking the students to share with the class what they just discussed with their partners.

Possible questions:

What did you discover about different types of volcanoes? (the teacher could draw diagrams on the board, or use the simulation the students used as a visual)
Where on Earth do you find volcanoes? How is that related to earthquakes?
What did you discover about volcanoes that aren't located on the Earth's plate boundaries? What are those called?
Did anybody find out what kind of Volcano Yellowstone is? How do we know that?

- **Elaboration:**

Students will add another paragraph to their original journal entries about what they now know about volcanoes, and how their personal experience with volcanoes they wrote about before may have gave them a different idea about volcanoes then they have now.

Students will acquire new vocabulary throughout the duration of the lesson including: Active, Dormant, Extinct, Magma, Chamber, Conduit, Vent, Cinder Cone, Composite, Shield Volcano, Lava Dome, Hot Spots, Fault Zones, Subduction Zones, Geothermal, Mafic, Intermediate, Felsic, Igneous, Extrusive, Intrusive. A vocabulary wall will be available and posted in the classroom throughout the duration of the entire volcano unit.

- **Evaluation:**

Students will demonstrate that they built upon their previous knowledge about volcanoes by using the provided simulations to correctly answer the questions on the web quest. Students will also be able to explain and discuss what they have learned in a class discussion, as well as compare their previous knowledge of volcanoes to what they discovered during the activity by writing a paragraph in their science journals.

Formative: The teacher will check for understanding throughout the web quest activity, as well as asses students on their willingness to participate during the class discussion.

Summative: Students will turn in a completed web quest activity to demonstrate completion and understanding of the content for a grade. Openers will also be assessed for completion points, as well as demonstration of understanding and building on or correcting previous knowledge.

Differentiation:

Students with special learning accommodations:
Reading: Students with IEPs for reading will be placed with an aide, or a more advanced student to help with deciphering the volcano information.
Writing: Students with IEPs for writing may type their answers on the computer, and just do the diagrams on the handout.
Social: Students with social issues may work in a quiet place alone, or wear headphones.
Time: Students who need more time to complete the activity will be given the option to work at home, or in the classroom during lunch, or before or after school.
*All students with 504s and IEPs will use a worksheet that has a link provided for every question.

Extensions for advanced students:
The advanced class will be given an extended version of the web quest and be required to answer all questions. Advanced students in other classes will be give the option of exploring further questions for extra credit.

Safety Considerations:

Students should have a procedure in place for retrieving classroom computers or iPads to avoid everybody going at once.
Procedures should be in place for students to relocate to the computer lab or library if necessary for computer use.
Students are not to use any other website other than what is provided for the web quest. In order to prevent this from happening, the teacher will keep close proximity to students at all times by continually walking around the classroom and observing the work of the students. If a student is found off task and on another website, a closer proximity will be kept, and a warning will be issued.

Lesson 2

Properties of Magma Viscosity Lab

Created By: Lauren Huntington

Volcanoes/Earth Science/7th Grade

Lesson Overview:

This is a laboratory exercise in which students will work in pairs to explore viscosity by measuring how fast different household items like cooking oil and nacho cheese flow. Students will relate their measurements to properties of magma.

Duration: 1 50 minute class period

Objectives:

Students will be able to explain why some fluids flow more easily than others.
Students will infer what factors determine the viscosity of magma.
Students will describe a fluid as having "high" or "low" viscosity.

NGSS Standards Addressed:

MS.Earth's Systems
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Crosscutting Concepts:
Scale Proportion and Quantity
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Science and Engineering Practices
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 nature operate today as they did in the past and will continue to do so in the future.

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Materials:

Clear plastic cups: enough for 4 per group
Syrup/molasses/honey: Each group gets 1 cup approximately 2/3 full.
Cooking oil (vegetable/canola). Each group gets 1 cup approximately 2/3 full.
1 straw per student, cut in half
Stopwatches (1 per group)
Data sheet (Handout #2 in instructional Materials)

12 inch ruler -1 per group

5E's

- **Engagement**

  Students are engaged during the class opener by answering the question posted on the board on their openers handout.

  The teacher will provide the writing prompt for all students to see upon entering class. It can be written on the whiteboard, or projected on a screen. The prompt is "Define viscosity. Do some research if you need to."

  Students will have about 5 minutes to answer, and then participate in a discussion.

  The teacher will define viscosity on the board as "how quickly a substance flows depending on the internal friction."
  - ° How "sticky" a fluid is
  - ° The viscosity of a liquid is determined by a variety of factors, some of which include temperature, the kinds of bonds present, and the stresses applied to the liquid

- **Exploration:**

  Students will conduct a laboratory investigation with a partner in which they test the viscosity of vegetable oil, and syrup/molasses/honey (whichever is available) by timing how long it takes to pour the entire contents of the cup into another cup from 12 inches above. Students will record their findings, and answer questions about viscosity on a laboratory handout. Before students conduct the pouring and timing part of the investigation, each student will blow into the liquid and observe the differences in how forceful they had to blow to get a bubble, and what the bubble was like.

- **Explanation:**

  The class will discuss their findings from the laboratory investigation. The teacher will list common household liquids on the board, and the class will put them in order from high viscosity to low viscosity.

  Questions will lead the class to relate their findings to magma.

  Possible questions:

  What determines viscosity?
  How does temperature affect viscosity?
  How would your results change if you heated up your honey before testing the viscosity?
  What factors determine the viscosity of Magma? (silica content and temp)
  How would viscosity effect how forceful an eruption is?

- **Elaboration:**

  Students will think of a fluid that wasn't discussed, and write it in their science notebooks. They will determine if that fluid has high or low viscosity.

  Students will acquire an understanding of the word viscosity.

- **Evaluation:**

  Students will demonstrate that they made connections between the investigation and lava flow by correctly answering the questions provided on the laboratory investigation handout. Students will also be able to explain and discuss what they have learned in a class discussion.

  Formative: The teacher will check for understanding throughout the lab, as well as asses students on their willingness to participate during the class discussion.

  Summative: Students will turn in a completed laboratory handout.

Differentiation:

Students with special learning accommodations:
Reading: Students with IEPs for reading will be placed with an aid, or a more advanced student to help with reading the handout and lab instructions.
Writing: Students with IEPs for writing may type their answers on the computer.
Social: Students with social issues may work on the lab investigation alone, or with an aid.
Time: Students who need more time to complete the activity will be given the option to work in the classroom during lunch, or before or after school.

Extensions for advanced students:
The advanced class will be given an extended version of the lab by measuring the viscosity of other items at home, then bring their findings in to class to discuss.

Safety Considerations:

Students will wear safety goggles at all times during the investigation.
Students will be familiar with the eyewash station, as well as where the sinks and other safety equipment are located.
Students will know proper cleanup and laboratory procedures.
Students will be instructed to not ingest any of the lab material.

Lesson 3

Volcanic Landforms

Created By: Lauren Huntington

Volcanoes/Earth Science/7th Grade

Lesson Overview:

A powerpoint presentation will be presented and discussed about the landforms that are created by lava and ash including the different types of volcanoes, lava plateaus, calderas, soils, volcanic necks (Devil's tower), dome mountains, as well as the Geothermal activity that comes with volcanic activity. Students will also read an article titled "Hot Spot at Yellowstone" by Abby Dress, which addresses calderas and geysers. The teacher will then demonstrate the formation of a caldera by using flour, a balloon, and an air pump. If materials are not available, a video clip of the demonstration will be shown.

Duration: 1-2 50 minute class period

Objectives:

Students will be able to identify landforms that lava and ash create, as well as examine other distinct feature of volcanic areas.

NGSS Standards Addressed:

MS.History of Earth

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Disciplinary Core Ideas:

ESS2.B: Plate Tectonics and Large-Scale System Interactions

Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.

MS.Earth's Systems

MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Materials:

"Hot Spot at Yellowstone" reading
Nearpod presentation
Small plastic tub with a small hole in the side
Balloon
Flour
Manual air pump

5E's

- **Engagement**

  Students will be presented with an opener upon entering class. The teacher will provide the writing prompt for all students to see upon entering class. It can be written on the whiteboard, or projected on a screen. The prompt is “What is a Caldera? What is a crater?”

  Students will have 5 minutes to answer the question.

  The teacher will then facilitate a quick discussion on what students may have answered.

  Possible questions:
  What does a caldera look like?
  What happens to change a crater into a caldera?
  How does a caldera form?

- **Exploration:**

  Students will follow along and discuss slides during a Nearpod presentation. The presentation includes quick assessments that go along with the slides. The Nearpod will explore shield volcanoes, cinder cone volcanoes, composite volcanoes, lava plateaus, calderas, soils from lava and ash, volcanic necks, dikes and sills, batholiths, dome mountains, and geothermal activity. Students will also read an article that discusses Yellowstone’s volcanic activity.

- **Explanation:**

  Students will summarize what they read in their science notebooks, and partake in a “Think. Pair. Share.” with their table partners to discuss what they read, then participate in a class discussion on the reading.

- **Elaboration:**

  The teacher will provide a demonstration for the students that shows how calderas are formed. The teacher will inflate a balloon covered in flour, then deflate the balloon to show that the flour craters where the balloon deflated. If materials are not available, a video clip of the demonstration will be shown.

- **Evaluation:**

  Students will demonstrate an understanding during the “Think. Pair. Share” activity with a partner, as well as participate in a class discussion. The Nearpod evaluates students for understanding by asking multiple choice, short answer, and drawing questions throughout.

Formative: The teacher will check for understanding during the Nearpod presentation by assessing in real time using the Nearpod program as well as after the reading by facilitating discussion.

Summative: Students will summarize the reading in their science notebook.

Differentiation:

Students with special learning accommodations:
Reading: Students with IEPs for reading will be placed with an aid, and given more time to read the article.
Writing: Students with IEPs for writing may type their summaries on the computer.

Safety Considerations:

Students will wear safety glasses during the demonstration.

Lesson 4

Thunder Island

Created By: Lauren Huntington

Volcanoes/Earth Science/7th Grade

Lesson Overview:

This activity is a volcano monitoring simulation. It involves students dealing with 'real-time' data that they have to process within a short timeframe and then provide their expert advice to another team.

Duration: 1 50 minute class periods

Objectives:

Students will apply information about volcanic hazards to simulate preparation for a hazardous situation.

NGSS Standards Addressed:

MS.Earth's Systems

MS - ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Science and Engineering Practices: Analyze and interpret data to provide evidence for phenomena.

Crosscutting Concepts: Patterns

Patterns in rates of change and other numerical relationships can provide information about natural systems.

Materials:

Thunder Island simulation handouts (Lesson 4 instructional materials)

- Background
- map
- Hour strips for each team
- Eruption Center
- Well Water and Weather Team
- Deformation Monitoring Team
- Seismic Team

5E's

- **Engagement**

Students will be engaged by numbering off 1-4, and dividing into four groups at the beginning of the class period. Group one will go to the part of the room labeled seismic team; group two will be the deformation monitoring team, group three will be the well water and weather team, and group four will be the eruption center. Each student will get a “Thunder Island” handout with some background information. The teacher will project the handout on the board, and will go over the handout with the class. Students will take turns reading sections.

- **Exploration:**

  Each team has their own specific handout to read. Students will be given a few minutes to go over their team handout in order to determine what their role is. Each team has a different role in the simulation to monitor the volcanic activity and keep the residents on the island safe. The eruption center advises local people of the eruption warning for each hour, the other three teams will provide the information needed. The well water and weather team monitors the temperature changes in the five wells around Thunder Island. This team will gather for any rise in temperature beyond 10 degrees celsius, which means moving magma, as well as monitor wind speeds. This team gives advice to the Eruption Control Center. The deformation monitoring team monitors any change in the slopes of the volcano. This team will analyze the information and provide advice to the Eruption Control Center. The seismic team monitors seismic activity as recorded by the five seismic stations located on Thunder Island.They will provide advice to the Eruption Control Center as well.
  The teacher will decide on an interval to give out each “hourly” data sheet. Between 8-10 minutes works well. At each interval, each group will receive new data sheets to analyze and decide what to relay to the control center. The control center will then decide what to inform the residents.

- **Explanation:**

  Once the simulation is complete, students will discuss the simulation. Some teams will feel they never had enough time to fully analyze the data, which made things stressful. The teacher will lead students to relate the stress of this activity to what they think happens in the real world.

- **Elaboration:**

  Students will write a reflection about the simulation. They will talk about what happened during the simulation, and relate it to real world situations.

- **Evaluation:**

  Students will be evaluated by their participation in the simulation. They will demonstrate a take-away from the activity by writing a reflection in their science notebooks.

  Formative: The teacher will check for understanding throughout the activity, as well as asses students on their willingness to participate..

Summative: Students will write a reflection about the simulation in their science notebooks.

Differentiation:

Students with special learning accommodations:
Reading: Students with IEPs for reading should not have an issue, since this a group effort. The background information will be discussed as a class, and the group instructions should be clarified by an aid or the teacher if students are struggling to understand.
Writing: Students with IEPs for writing may type their science notebook entries on the computer.
Social: Students with social issues will be encouraged to participate in the simulation. The teacher or an aid may provide extra support.

Extensions for advanced students:
The advanced class will be given an extended version of the activity by researching what real volcanologists do.

Safety Considerations:

Procedures will be in place for students to move to their groups without any issues. The classroom will be set up so the four groups can easily move around the room.