**Title for Lesson Plan:** Weathering Labs **Your Name:**

Date of Lesson (if appropriate/relevant):

Approximate (Amount of) Time Required for Lesson: 50 minutes

Grade Level/Subject(s): 10th grade Earth Science

Central Focus of the Learning Segment:

Students will review concepts related to weathering and erosion

Related Prior Learning: Students are assumed to recall both types of weathering (chemical and physical). Students should recall water movement and changes to land.

Illinois Standards

Practices: Developing and using models, Planning and carrying out investigations, Analyzing and interpreting data, constructing explanations (for science), Engaging in argument from evidence, Obtaining, evaluating, and communicating information

[ESS2.A: Earth’s Materials and Systems](http://www.nap.edu/openbook.php?record_id=13165&page=179) **(DCI)**

·  [All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms. (MS-ESS2-1)](http://www.nap.edu/openbook.php?record_id=13165&page=179)

[ESS2.C: The Roles of Water in Earth's Surface Processes](http://www.nap.edu/openbook.php?record_id=13165&page=184) **[(DCI)](http://www.nap.edu/openbook.php?record_id=13165&page=184)**

·  [Water’s movements—both on the land and underground—cause weathering and erosion, which change the land’s surface features and create underground formations. (MS-ESS2-2)](http://www.nap.edu/openbook.php?record_id=13165&page=184)

Cross cutting:

* [Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.](http://www.nap.edu/openbook.php?record_id=13165&page=98)

**Performance expectation**:

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| MS-ESS2-2. | Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (Performance expectation) |

 (Note: This is the first earth science lesson in the unit of a high school earth science - the rock cycle. The standards addressed here include middle school standards because it is common practice to review and develop these standards/concepts at the start of a high school chemistry course.)

(Cross Cutting) Stability and change

Materials/Instructional Resources

· Limestone

ׄ Tweezers

· HCL

· Sand

· Pennies

· 10 beakers

· Salt

· 1 teaspoon

· Vinegar

· 2 Large pans/ cookie sheets

· Ruler

· Drinking straws

· Water

· small cups (dixie cups?)

· Eye droppers

· Pebbles

· Bucket

· Paper towels

· Preferably baby food jar but camera roll container will work

· Sugar cubes

· Video found here:<https://www.youtube.com/watch?v=oENxi-38m8U>

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| --- | --- |
| Objectives Students will model weathering and erosion of the surface of the earth and will use data and evidence from the simulations to support and explain that both chemical processes (primarily with acids and oxygen) and physical forces (primarily wind, water, and glaciers) can break rocks, soils, and sediments into smaller particles and/or move them around, resulting in changes in land’s surface features.   | Assessment-Reflecting questions in packet-Explanations of whiteboards-Classroom discussions    |

OPTIONAL: Review vocabulary with the students:

Physical weathering: Rocks are being broken apart but are not changing

Chemical weathering: Processes that cause ***exposed*** rock to undergo chemical decomposition, which is the change of chemical and mineral composition of the rock

Erosion: the process by which the surface of the earth is worn away by the action of water, glaciers, winds, waves

Moraine: Build up of rocks at the end of a glacier

Instructional Strategies and Learning Tasks (Procedure)

Tell students that today they are going to be conducting 6 different experiments in order to dive deeper into chemical and physical weathering. Let them know that the class is going to begin with a little discussion, then will go into the lab, and will follow up with whiteboard presentations and discussion. Tell them that the class is going to begin with the definition of chemical and physical weathering, and this is something they should remember from middle school. Ask them to share their definitions; answers should sound like the following:

**Physical weathering: Rocks are being broken apart but are not changing**

**Chemical weathering: Processes that cause *exposed* rock to undergo chemical decomposition, which is the change of chemical and mineral composition of the rock**

Ask students if weathering and erosion are the same thing – they will most likely say yes. Then ask them if they know the difference between the two. Tell them that it is a misconception that they are the exact same thing. Although they are similar in process, **weathering is something that takes places in a stationary fashion, whereas erosion is the transport and movement of sediment to a new location.**

Pull up a picture of Matthiessen State Park, Lower Dells and tell students that this is the phenomena that we will be working to uncover. This park is in Illinois, but how could it be created and does the mean the changes are over?

With that being said, the investigation question is: How does weathering and erosion change surface materials on earth (rocks, soil) and is it an ongoing process?

Hand out the lab packet to the students while reminding them that there are 8 different stations. Tell them that they will be working in a group of 3 to work through the lab (4 groups of 3). Each student should be turning in their own lab, but they may share their results with their partner.

Go through the activities with them briefly; in doing so, read what they are doing off the packet, so they know that what you are saying is directly from the packet and they can read it as they get to each station. Remind them of the safety features on the HCL lab, and the cleaning procedures of the HCL lab and the sand lands. When you get to HCL lab, tell students limestone is found near water as something to keep in mind.

Do first station as a class as this is a video. Tell them you are introducing one new vocabulary word: a moraine.

**Moraine: a pileup of rocks at the end of a glacier.**

This is something they will need to understand for the final question after station 1.

Tell students that once they finish the lab, they will be able to choose which station they want to present on the whiteboards to discuss with the class.

Station 1: Glaciers

This is done together as a class.

 Put this video up on the screen:<https://www.youtube.com/watch?v=oENxi-38m8U> and ask students to record their observations and to answer the questions underneath station 1. Tell students to draw a model for where the rocks begin, and some of them ended up.

For each station, students should be drawing what is happening to the rock or the sediment in which they are investigating underneath each station on the lab worksheet. They should clearly indicate which imagine is the before and which is the after so that they can reason to the rest of the class as to what occurred.

Station 2: Limestone and HCL

Remind students that HCL is an acid and they this is not something they should ever put into their mouths. Also remind students that acid can burn through clothes; however, this acid is not strong enough to do that. Have them think about the idea of acid being strong enough to burn through clothes, what does that look like how that could be happening. Question to focus on: Is the rock changing at any point in this investigation?

Review the activity instructions provided in the attached worksheet.

Students should record their observations and predictions on their worksheet. They should also, again, draw their before and after picture of what they saw occurring.

Station 3: Penny lab

Tell students that vinegar is an acid. Let them know that they will have to wait 10 minutes to view their penny again, and therefore they should do the investigation and come back to their penny.

Review the investigation instructions on the worksheet.

Encourage students to pour the salt over the penny with something to catch the remaining salt underneath it. Make sure that students recognize this and draw it in their representation of what is occurring.

Station 4: Sugar Cube

Each student should be using their own sugar cube. Tell students that they should not be banging the jar on the table, they should just be vigorously shaking the jar with the sugar cube and gravel inside.

Review the investigation instructions on the worksheet.

For the size of the cube, have students focus on the size before and after the shaking, as well as where the broken off pieces landed in relation to the gravel. Students should be drawing their before and after picture on the worksheet as well.

Station 5: Wind

Tell students to think about what size sediment can be moved by wind. Their experience should lead them to conclude that wind is generally not that strong and can usually only move smaller sediment. They may think of tornados that have the ability to move things like houses, but remind them that wind happens every day, tornados do not.

Review the investigation instructions on the worksheet.

Students should conduct their investigation in the pan only. They should clean up any sand that lands outside of the pan. As always, they should investigate, write their results as well as draw the before and after picture of what happened.

Station 6: Water

Remind students that this would look similar to something they would see if they went to a beach; the sand changes and moves as water hits it. Make sure that all students are starting with fresh sand.

Review the investigation instructions on the worksheet.

Have students do their investigation, write down their observations, and throw the wet sand into the bucket placed next to the table.

Conclusion:

Once students have finished the lab they will choose which station they would like to present on their whiteboard by writing their name next to the station on the whiteboard on the side of the classroom. Tell students they should finish the questions in the packet, if they haven’t. They should be filled out on the lab packet, but these questions get transferred over to the whiteboard, as these are the questions they will be presenting on to the class. See answer key to see information that students should be presenting.

Wrap up discussion:

“Alright you all did great today. Just as a recap, we discussed at the beginning of class about both physical and chemical weathering and how that differs from erosion. Then you all went and experimented with both chemical and physical weathering through the lab. We discovered that chemical weathering will change the appearance of the item t is weathering, whereas physical weather will just break the item apart.

You all made predictions about where in Illinois these features can be found, and in tomorrow’s lesson you will be exploring a place where you can without a doubt see these features. However, before that lesson there is some vocab we need to discuss. The processes we saw today can present themselves in different geologic features on land (i.e with wind and sand.)

*Present students with picture of ripples.* Here we can see what we call ripple marks. This is a desert, so clearly there is no water here; however, we can assume because of these marks that there once was water here. As water moves, it carries sediment in the direction of its flow, and it will be indicative through the sediment which way the water was flowing.

Overall, water is a very powerful tool. With its ability to expand as it freezes, it can crack a rock in half in a short period of time. Water seeps into rocks due to high porosity and permeability and then freezes. The water fills spaces in the rock but then it begins to freeze and fill the space where the rock once once. This means that the rock has no other option other than to start cracking to make room for the ice that has taken over. This often happens when glaciers melt over sediment.

*Show students picture of cross bedding.* Similarly to water, cross bedding indicates the direction the wind was blowing. These are all features you will be exploring more tomorrow.”

Instructional Materials