Rocking Through the Rock Cycle

Lesson Summary: (Grade Levels: 5-8) The students will participate as if they are matter traveling through the rock cycle while drawing cards from 4 rock matter stations (magma, igneous, sedimentary, and metamorphic). Afterwards, the student will demonstrate their path using a laser pointer in a projected image of the rock cycle diagram.

Missouri Learning Standards: 5.ESS2.A.1

Grade 5. Earth Systems. Strand 2 Earth Material System: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interreact.

Missouri Learning Standards: 6-8.ESS2.A.2

Earth Systems Strand 2 Earth Materials System: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Materials: This lesson requires cut out *Rock Station Cards* (3 copies of each station sheet), a laser pointer, a projected picture of the rock cycle and 4 small containers (baskets or boxes for cards). If possible, sample rocks from each rock group can be set around the card station for each of the three rock groups for students to observe while they wait to draw cards. Provide hand lenses at each station so the students can observe the rocks samples closely. Optional materials include a lava lamp for the magma station and a microscope with sediment at the sedimentary station.

Safety Considerations: The students need ample room to move about in the activity. In addition, students need to be directed on how to use the laser and NOT to point that laser at anyone at any time. If using a lava lamp tell students not to touch and have a sign next to the lamp to remind them. A lava lamp gets very HOT!

Prerequisite Knowledge: *Students should know the following terms: igneous rocks, sediments, sedimentary rocks, metamorphic rocks, magma, lava and weathering.*

Vocabulary: The lesson introduces the term **rock cycle**.

Qualitative Observations and Quantitative Measurements: The students will make qualitative observations by examining any rocks displayed at the rock group stations (sight and touch) and by observing the pathways that students make through the rock cycle diagram. Students will be making quantitative measurements by counting how many times they traveled through each rock station and the percentage of time that they spent in each station.

Possible Misconceptions: Students will have difficulty conceptualizing the vast amount of time that this activity represents. Students need to understand that this lesson is a random presentation of complex processes that occur between the Earth's geosphere, hydrosphere and atmosphere over millions of years. In addition, the rock cycle occurs over a vast area both on and under the Earth's surface.

Lesson Instructions:

Preparation:

Make 3 sheets of each set of station cards. If possible, copy each set on a different color of paper so each set won't get mixed up.

Make a sign for each of the following stations: Magma Station (1's start here) / Sedimentary and Sediments Station (2's start here) / Metamorphic Station (3's start here) / Igneous Station (4's start here)

Cut out the cards, mix them up and place them face down. Place each set of cards with the corresponding sign at the desired station location. Place the cards in a small box or basket.

Gather hand lenses, sample igneous rocks, sedimentary rocks and metamorphic rocks with hand lens for corresponding stations. If available, include a lava lamp for lava station and a microscope with sediment slides for the sedimentary station. Have a rock cycle picture projected and a laser pointer ready.

Warm Up:

Have students make a brainstorm list of things that they know go through a cycle. Facilitate a group discussion off of their lists.

Tell students that rocks also go through a cycle and that they are going to act as if they are matter traveling through the rock cycle. Inform them that they will be traveling through the *rock cycle* activity very quickly, but in reality this cycle takes thousands, millions and even billions of years to occur.

Explain that they will change as they travel through the rock cycle as a result of internal forces in the Earth (heat and/or pressure) and external forces outside the Earth in the atmosphere and hydrosphere (weathering agents: frost wedging, wind and water abrasion, expansion/contraction, action of gravity, chemical decomposition, glaciers, and root wedging).

If students have covered physical and chemical changes of matter, explain that these processes are occurring as well as matter moves through the rock cycle. Include review of the following terms: *igneous rocks, sediments, sedimentary rocks, metamorphic rocks, magma, lava and weathering.*

Main Lesson / Activity Steps:

1. Have the students count off from one to four. Tell the ones that they will start at the magma station, the number two will start at the sedimentary station, the threes will start at the metamorphic station and the fours will start at the igneous station.

2. Tell students to number a sheet of paper from 1 to 25 and write *Rocking Through the Rock Cycle* at the top. Tell them that they are going to draw a total of 25 cards during the entire activity.

3. Each number on the paper should correspond with the station that they draw the card from. If they draw a "stay" card they need to record the name of the station they are at and then draw again. Explain that rocks spend a lot of time "staying" in one place for many, many years! They may have to stay and draw at the same station several times, before they can move on! Explain that they need to take their paper and a pencil with them as they travel through the rock cycle to record their rocking journey as they go from station to station. Each person goes on their own journey!

4. Next, have students go to their station (1, 2, 3, 4 that they numbered off). Tell the students to draw a card at that station then read and record what happens to them on their sheet. Next, they need to do what the card tells them to do. After they draw a card, the card should be placed at the bottom of the pile in the basket or box. Each time they draw they need to record the location designated on the card and follow the directions (stay, or go to…).

5. Let the students travel through the rock cycle and record their journey for 25 trips. If you are using rock samples at each station, they could observe those samples while at each station.

6. Have students share their trip by using the laser pointer and showing the path of their rocking journey on the projection illustration of the rock cycle. Discuss the processes involved with each step.

Wrap Up:

Have the students share what they learned in the activity and what things surprised them. Ask the students if they went to all stations or just some. Have them speculate as to why they may or may not have traveled to all stations.

Emphasize that the rock cycle is a very slow process that occurs over thousands and even millions of years between the geosphere, hydrosphere, atmosphere and biosphere. Have students identify areas of the hydrosphere and atmosphere that were involved in the rock cycle.

Be sure students comprehend the difference between internal forces (heat, pressure and mantle convection currents inside the Earth) and external forces outside the Earth (weathering), which are both rock cycle forces of change. Embed the term *extrapolate* and *scenario* during the wrap up by noting that they can *extrapolate* how matter moves through the rock cycle based on the *scenario* they each encountered during the activity.

Modifications:

The lesson difficulty could be decreased by making the following adaptations:

To assist students with difficulty writing and recording information, give students a form with all four stations listed. Have the students place the number for each drawing they make under the name of the station.

If students may have difficulty reading the cards, pair those students with a stronger student. Have them go through the journey together.

The lesson difficulty could be increased by the following additions:

Have the students create a comic strip of several frames showing how matter moves through the rock cycle.

Have them make the rock matter (atoms) in the comic strip tell about the changes that are occurring to them.

Have students determine, based on their number of cards they drew, what percentage of time they spent in each station.

Assessments:

To assess students learning, have them label the internal and external processes involved on a rock cycle diagram without labels.

Igneous Station Cards (copy 3 times)

Stay, you are going nowhere! You are part of the Earth's crust!	Rainwater, which is slightly acidic, has slowly dissolved you at the Earth's surface. Go to Sedimentary Station!
Stay, you are going nowhere! You are part of the Earth's crust!	You have been pushed further down into the crust of the Earth. Stay put!
You are still a buried igneous rock formed by the cooling of magma! Your crystals are large and beautiful. Stay put!	Mountain building has pushed you further down into the crust of the Earth. You are so far now that you have been squeezed and heated. Your minerals have rearranged and changed. Your crystals have been squeezed into wavy layers. Go to Metamorphic Station!
You have been weathered at the Earth's surface by frost wedging. Go to Sedimentary Station!	Mountain building has pushed you further down into the crust of the Earth so that you have melted into magma. Go to Magma Station!
You have been weathered at the Earth's surface by wind and water. Go to Sedimentary Station!	Mountain building has pushed you further down into the crust of the Earth so that you have melted into magma. Go to Magma Station!
The roots of plants and burrowing animals have weathered you. Go to Sedimentary Station!	You have been pushed further down into the crust of the Earth. You are so far now that you have been squeezed and heated. Your minerals have rearranged and changed. Go to Metamorphic Station!

Magma Station Cards (copy 3 times)

You are too hot! Stay below the Earth's surface!	You cooled slowly and developed large crystals. Go to Igneous Station!
You won't cool down! You are trying to get above the Earth's surface, but have not made it. STAY!	You cooled slowly and developed large crystals. Go to Igneous Station!
STAY!!!	You just blew out of a volcano! No crystals for you. Go to Igneous Station!
Guess What! You are staying!	Guess What! You are staying!
You have erupted from a volcano! Go to Igneous Station!	BOMBS AWAY! You just blew out of a cinder volcano cone! Go to Igneous Station!
You have erupted from a volcano! Go to Igneous Station!	STAY!!!

Sediments / Sedimentary Station Cards (copy 3 times)

You have settled to the bottom of a great blue sea! You have settled, compacted and cemented. Enjoy the rest! STAY!	Oops! You have been weathered away! But - guess what - you are still sediments! STAY!
STAY FLAT - you are going nowhere!	You have settled, compacted and cemented, you are going nowhere! STAY!
More sediments are being buried on top of you! Enjoy the pressure during your stay!	You have had way too much pressure and heat! Go to Metamorphic Station!
You have been uplifted and weathered! You have changed from a sedimentary rock to sediments. STAY!	You have been buried so deep and for so long, you have now melted! Go to Magma Station!
You have been pushed down so far the heat is just too great! You melted, go to Magma Station!	The pressure is just too great! You have rearranged your crystals. Go to Metamorphic Station!
You have settled to the bottom of a great blue sea! Enjoy the rest! STAY!	You have been buried so deep and for so long, you have now melted! Go to Magma Station!

Metamorphic Station Cards (copy 3 times)

STAY!!! You continue to be hard pressed.	You have been uplifted to the surface of the Earth and weathered! Go to Sedimentary Station!
You are stuck between a rock and a hard place! Stay!	You have been uplifted to the Earth's surface, but you are hard and resistant to weathering! STAY!
You have been buried even deeper! You have gone through recrystallization again!!! Stay!	You are up lifted, weathered, and traveled downstream as sediments. Go to Sedimentary Station!
You have been buried so deep you melted! Go to Magma Station!	You are stuck and going nowhere! Stay!
You have been buried so deep you melted! Go to Magma Station!	You are up lifted, weathered, and traveled downstream as sediments. Go to Sedimentary Station!
More pressure and heat have rearranged your atoms and crystals! STAY!	More pressure and heat have rearranged your atoms and crystals! STAY!