

Rock Cycle Game For the Teacher

Learning Stage Cycle: Extension

Lesson Title: Rock Cycle Game

Lesson Overview: Using manipulatives, students will reinforce their understanding of how rocks change over time.

Instructional Goal

The students will identify factors that cause rocks to break down and change through numerous pathways in the rock cycle.

Formative Assessment

Concept map

Lesson Organization

Opening the lesson – Time Allocation: 15 minutes

Distribute manipulatives and give instructions for the rock cycle game. Demonstrate how the game is played.

Developing the lesson - Time Allocation: 10 minutes

Allow students to play the game. As a group, discuss the factors that cause rocks to break down and change indicating possible pathways in a rock cycle.

Ending the lesson - Time Allocation: 25 minutes

Students will demonstrate their understanding of the rock cycle by developing a concept map showing the three (or five stages of development) rock types and how they change. This can be done on the rock cycle created during the game, a plain sheet of notebook paper, or on one of the templates below.

Instructional Strategies - Tennessee Goals and Themes

Observing

Formulating Questions

Collecting Data

Analyzing Data

Explaining

Communicating

Models

Organization

Interaction

Change

Teaching Resources

1. Word cubes for rock cycle game – see below for a template to create your own –
2. Word cubes game can be purchased from Tennessee Earth Science Teachers– contact Don W. Byerly at dbyerly@utk.edu
3. Concept Map template – see below

Enrichment Activities

1. Watch and discuss a video on the rock cycle – possible vendor is Scott Resources, Inc. P.O. Box 2121 Fort Collins, Colorado 80522 or phone 1.800.289.9299 "Rock Cycle"

The Rock Cycle Game

Introduction

This activity illustrates the general scheme of the rock cycle through visualization and movement. Students move between geologic states as random rolls of a word cubes directs them. The word cube used for each station (geologic state), has different possible processes that the particular state can undergo. The options are somewhat proportional so that the students will get an accurate idea of the different processes each state can undergo while keeping the state moving.

Students should record their movements as they progress through the game. There is no time limit or winner of the game, so the instructor should end the game after each student has gone through several states in the cycle and has collected adequate data without getting bored with the game.

Procedure for game

Place stations around a large table to indicate the following states:

- Magma
- Igneous Rock (granite)
- Sediments
- Sedimentary Rock (limestone, with fossils)
- Metamorphic Rock (gneiss)

Place the example of the state and the specific word cube at the appropriate station. Students should elect a starting point in the cycle and take turns rolling the word cube to receive their directions. Give each student a colored pencil. If they change states have them color the appropriate arrow on the attached form. If they remain in a state, have the underline the appropriate state.

Procedure to make word cubes

Cut a 2x2 board of lumber into 1 1/2 " pieces. You will need five word cubes. Sand the cubes and cut out the templates (as close to the text as possible). Glue the templates on the cubes by using diluted Elmer's glue on a little paintbrush (OR use tag board to create and cut out a cube shape).

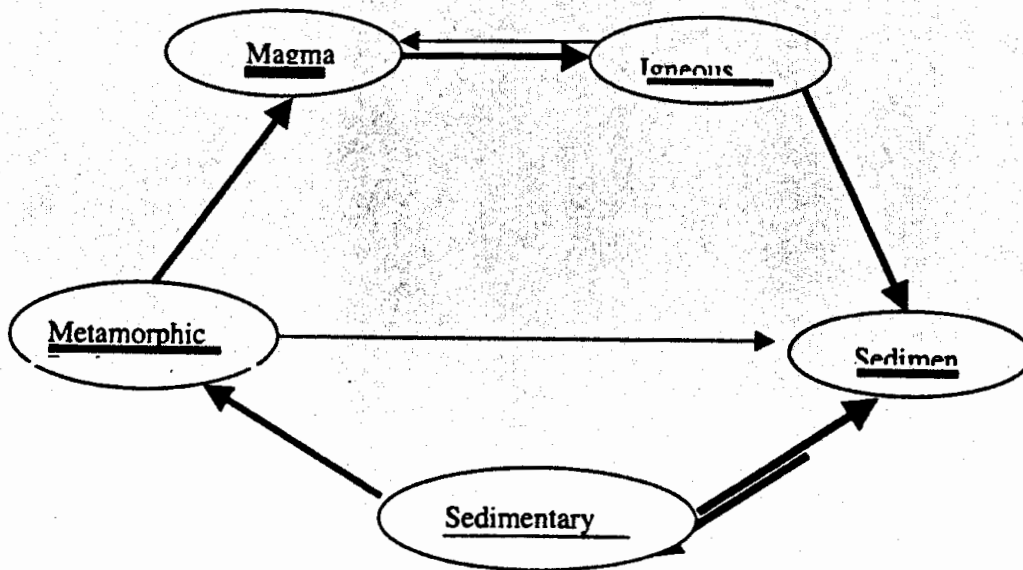
The Rock Cycle Game as a Model

Modern models are generally not physical like model airplanes, but are computer models, which use mathematics to predict outcomes based on a set of assumptions.

The Rock Cycle Game is a model of this sort. This is what it proposes:

1. The rock cycle does not go round and round in an orderly way. There is a large element of chance in change of state.
2. While there is an element of chance in rock changes, the rock cycle is not totally random. Rocks in a specific state can change to some other states, but not to all other states.
3. It is possible to determine the probability that a rock in a specific state will change to another state.
4. These are the probabilities.

Original State	New State	Probability
Magma	Remain magma	$4/6 = 67\%$
	Igneous rock	$2/6 = 33\%$
Igneous Rock	Remain igneous	$2/6 = 33\%$
	Melt to magma	$2/6 = 33\%$
	Weather to sediments	$2/6 = 33\%$
Sediments	Remain sediments	$3/6 = 50\%$
	Turn to sedimentary rock	$3/6 = 50\%$
Sedimentary Rock	Remain sedimentary rock	$1/6 = 17\%$
	Turn to metamorphic rock	$2/6 = 33\%$
	Weather to sediments	$3/6 = 50\%$
Metamorphic Rock	Remain metamorphic rock	$3/6 = 50\%$
	Melt to magma	$2/6 = 67\% \cdot 33$
	Weather to sediments	$1/6 = 33\% \cdot 17$



Testing the Model

Does this model accurately describe what happens to rocks on earth? Let's look at two sites in Tennessee.

Mountains of East Tennessee.

- Early Paleozoic – through the mid-Ordovician, sediments accumulated
- Late Paleozoic – The region experienced mountain building as Pangea was formed. Magma rose toward the surface crystallizing into igneous intrusions. The heat from these intrusions and pressure from the collision changed igneous and sedimentary rocks into metamorphic rocks.
- Mesozoic to the present – The mountains formed in the late Paleozoic have been eroding. Igneous, sedimentary and metamorphic are eroding into sediments.

Answer: The model describes fairly well what we see.

Middle Tennessee

- Paleozoic Era – Sediment forms or is washed into the area, settles to the bottom and forms sedimentary rock.
- Mesozoic to the present – Sedimentary rock just sits there for hundreds of millions of years, gradually eroding back to sediments.

Answer: The model doesn't describe middle Tennessee rocks well at all.

Why not?

Answer: The rock cycle, like just about everything else in geology is fueled by plate tectonics. The full rock cycle generally occurs only on plate boundaries. Areas in the craton (the center of stable plates) have a very truncated rock cycle.

Adapted from work by the Warner Park Nature Center and staff and Nancy Setten.

Rock Cycle Game For the Student

Lesson Title: Rock Cycle Game

Learning Goal

You will diagram and explain the processes of the rock cycle.

Assessment

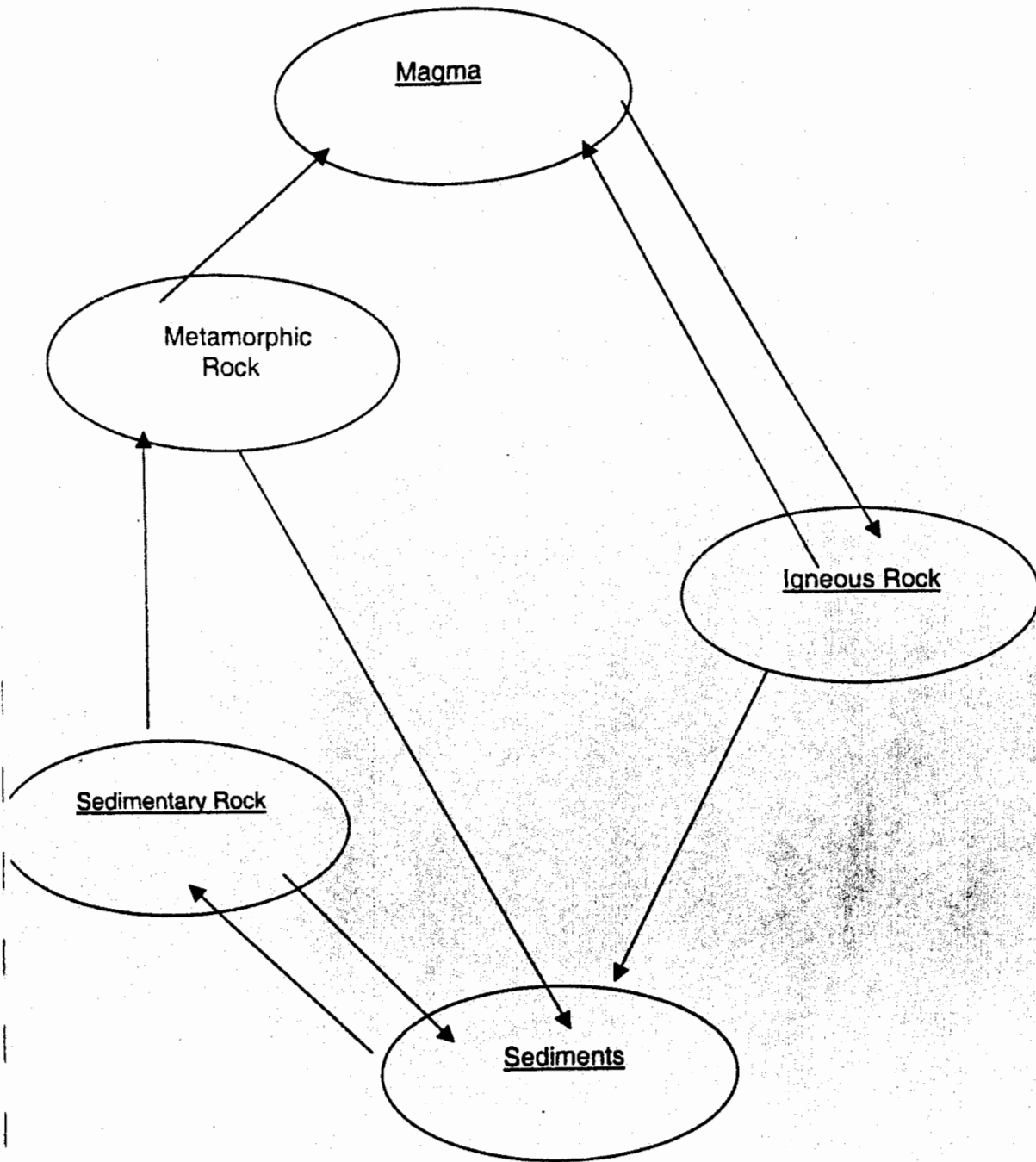
Concept map

Description of Learning Activity:

1. Go to the station the teacher indicates as your starting point.
2. Highlight with a colored pencil where you begin the game.
3. Roll the word cube. If you remain at the station, put a tally mark for each time you remain in that state.
4. After each person at the station has rolled the word cube, it is your turn to roll the word cube again. If you change into a different form, draw an arrow to the new state into which you have changed. Continue marking data sheet for each roll of the word cube.
5. After about 5- 10 minutes of rolling the word cube and recording data, the teacher will call time.
6. Return to your seat.
7. During class discussion the class will determine numerous factors and pathways for the rocks to break down and change.
8. After the discussion, use the concept map template to develop a representation of the rock cycle with pathways marked.

Materials and Equipment: word cubes, colored pencils, and concept map

The Rock Cycle Game Data Sheet

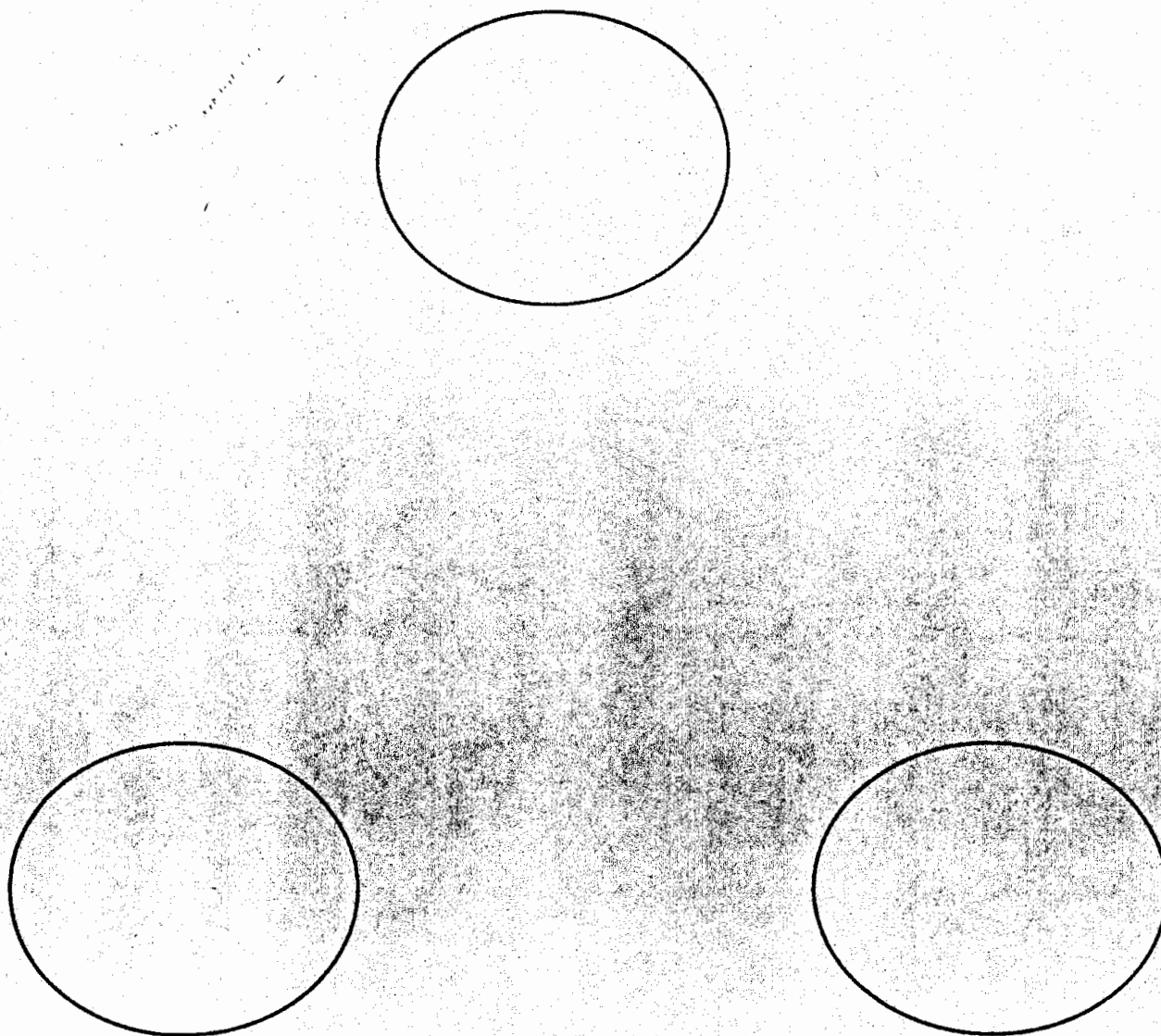


Magma Crystallize to form igneous rock.	Magma Crystallize to form igneous rock.	Magma Stay in this state.	Magma Stay in this state.	Magma Stay in this state.	Magma Stay in this state.
Igneous Rock Change to metamorphic rock.	Igneous Rock Weather into sediments.	Igneous Rock Weather into sediments.	Igneous Rock Weather into sediments.	Igneous Rock Weather into sediments.	Igneous Rock Stay in this state.
Sediments Turn in sedimentary rock.	Sediments Turn in sedimentary rock.	Sediments Stay in this state.	Sediments Stay in this state.	Sediments Stay in this state.	Sediments Stay in this state.
Sedimentary Rock Change to metamorphic rock.	Sedimentary Rock Weather to sediments.	Sedimentary Rock Weather to sediments.	Sedimentary Rock Weather to sediments.	Sedimentary Rock Weather to sediments.	Sedimentary Rock Stay in this state.
Metamorphic Rock Melt to magma.	Metamorphic Rock Weather into sediments.	Metamorphic Rock Stay in this state.	Metamorphic Rock Stay in this state.	Metamorphic Rock Stay in this state.	Metamorphic Rock Stay in this state.

Concept Map Template – For the Student

THE ROCK CYCLE

Before completion of the rock cycle game and class discussion, you should draw your representation of the rock cycle using arrows. Give examples of the processes that cause a rock to change from one type to another.



Concept Map Template – For the Student

THE ROCK CYCLE

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