

Overview:

In this lesson, students review types of rock and the stages of the rock cycle, and develop their own model for the features and processes of the rock cycle.

Objectives:

The student will:

- identify and define types of rock and their characteristics and relationship to the rock cycle; and
- create and describe a model of the rock cycle to show features such as weathering, sedimentation, and reformation.

Targeted Alaska Grade Level Expectations:

Science

[11] SD1.1 The student demonstrates an understanding of geochemical cycles by creating a model to demonstrate the rock cycle (L).

Vocabulary:

cooling and crystallization — after melting, the process by which igneous rock solidifies, either above or below ground, most often resulting in crystals

deposition and lithification –the process by which sediment is placed and tightly compacted under pressure, to form sedimentary rock

erosion – the process of breakdown and transport of rock and rock sediments by the natural environment, such as water, ice, or gravity

heat pressure and stress – conditions of specific, extreme heat (600-1200 degrees Celsius) and pressure (1500 bars) needed to form metamorphic rock

igneous rock – a major type of rock, formed through the cooling and solidification of magma or lava

magma - a mixture of molten rock found beneath Earth's surface

melting - process of liquefying rock through heat that results in igneous rock

metamorphic rock – a major type of rock, formed through intense heat and pressure and resulting in new forms and chemical makeup

rock cycle – set of transitions throughout geologic time between the three major rock types: sedimentary, metamorphic, and igneous

sedimentary rock –a major type of rock, formed through the settlement and accumulation of mineral and organic particles (sediment)

volcanic eruption – process by which pressurized molten rock (magma) is expelled from underground and becomes lava

weathering – breakdown of existing rock and soil through stationary contact with Earth's atmosphere

Materials:

- Aluminum foil
- Collection of old/used crayons and/or wax candles of various colors
- Copies of Student Materials sheet: "Cycle Components" (enough copies for each small group of 2-3 students to have at least one copy)
- Crayon or pencil sharpeners (hand-driven, not electric)
- Hot plate and/or microwave oven
- Safety scissors (one pair per small group)

- Samples of real igneous, sedimentary, and metamorphic rock (if available, a sample of each type for each small group); if rock samples are unavailable, pictures on “Cycle Components” sheets will do
- Wax paper
- VISUAL AID: “The Rock Cycle”
- STUDENT INFORMATION SHEET: “Cycle Components”

Activity Preparation:

1. Print enough copies of “Cycle Components” information sheet so that each small group of 2-3 students may have one copy.
2. On a table for the groups to see and share, assemble diverse collection of rock samples (if used), crayons, candle pieces, chips (if used), scissors, wax paper and/or aluminum, and “Cycle Component” sheets.
3. Ensure hot plate and/or microwave oven are in safe working order.

Activity Procedure:

1. Assemble students into small groups of 2-3 and have a representative from each group come up to retrieve a set of scissors and a Cycle Component sheet for his or her group.
2. While student groups cut apart Component pieces from Component sheets (in even squares is fine), review rock types and vocabulary terms on the sheets with the class, ensuring they are familiar and clear.
3. When students have completed cutting and separating Cycle Components, instruct them to arrange them in an order that models the proper **Rock Cycle**; that is, each stage and picture represented among the Components holds an important place in the rock cycle, and student models should show this. Students should note that certain terms/functions appear more than once. Give them 5-10 minutes to arrange Components in a proper order.
4. Depending on how well students are able to recall and describe stages in the rock cycle, it may be necessary to solicit questions, based on “The Rock Cycle” visual aid attached, while groups are working to arrange components.
5. Once student groups are comfortable with their order of arrangement, instruct them to return to the materials table and to select two or three different types/colors of wax crayon and/or candle pieces, scissors or crayon/pencil sharpener, and two sheets of wax paper (if using microwave) or aluminum foil (if using hot plate).
6. Instruct groups to model the creation of “**sediment**” (by shaving wax crayon/candle with scissors or sharpener) and to collect the shavings from their different types of “rock” onto one of their wax or aluminum sheets. As they create the shavings, prompt them to consider what process(es) in the rock cycle this step might mimic (Weathering and Erosion).

Teacher’s Note: Throughout this activity, ensure students have considered respective processes/stages in relation to their arrangement of Cycle Component paper slips. If they find discrepancies with their order, ensure that they have made and understand corrections.

7. Once sediment shavings are completed, instruct student groups to model the next stage in Rock Cycle (Deposition and Lithification; the placing and compacting of sediment). Ensure they arrange various wax “sediment” together, place protective second sheet of wax/aluminum on top and “compact” collection together. (NOTE: Compaction should be done by hand or fist, since harder stress/friction of feet and shoes should be reserved for next “**Heat Pressure and Stress**” stage.)
6. Once groups have completed Deposition and Lithification, pause to consider the product (**Sedimentary Rock**) and how/where it fits in their Cycle Component order. How does composition characterize it and distinguish it from other rock types?

- Next, instruct student groups to carefully place their wax "**Sedimentary Rock**" (still between its wax/aluminum sheets) on the floor. Here they will model the "**Heat Pressure and Stress**" stage of the rock cycle by first pressing it gently with their foot and then grinding with more pressure, until the sedimentary pieces have first broken apart to tiny pieces and then recombined. Note that it may take gentler and more uniform pressure, perhaps by hand; to get broken pieces to mold back together. (Teacher's Note: Briefly discuss folding and foliation in the metamorphic process. Foliation is defined as layering within metamorphic rocks caused by alignment of platy materials such as mica. Non-foliated rock has interlocking grains with no specific pattern.)

Critical Thinking Activity: More Taxonomy. In their groups, encourage students to consider the real-world products they are modeling (pass out rock samples, if they are available). Solicit suggestions as to why their models use wax to model the rock cycle, rather than real rock. (much easier to break, mold and melt). How much more intense must weathering: erosion, heat, pressure, etc. be to have similar effects on hard rock with which we're familiar?

Teacher's Note: If time allows, review Geological Time Scale and Law of Superposition)

- Students now have models of **Metamorphic Rock**. What processes and characteristic of the rock and its creation process characterize it?
- Carefully, and one at a time, assist student groups to melt their "metamorphic rock" in/on the microwave or hot plate. Ensure that wax/aluminum coverings are appropriate for the heat source, and explain to students that the heat source to melt rock is Earth's very hot core, and that the melting process actually happens deep underground.
- Monitor the melting process closely to make sure materials to not overheat. Once "rock" is melted, allow students to examine it (during its liquid, **magma** stage), but ensure it is cool enough to touch before groups return it to their stations. Explain that this cooling process happens either underground (Cooling and Crystallization) or above ground after it emerges, sometimes violently (**Volcanic Eruptions (lava)**)
- After all groups' wax "rock" has undergone the melting and cooling process; discuss the resulting product (**Igneous Rock**). What characterizes this type? Looking at it, what distinguishes its makeup from the Sedimentary and Metamorphic types?
- To conclude, discuss the potential for what could happen to the Igneous rock next—could they enact the same process again by shaving and pressing it together? Could it go directly to the ground to be crushed by their feet? Could it be melted and cooled again? What if new colors/varieties of wax were added to the new igneous product? Students should understand the rock cycle does not need to follow a specific order and depends on unpredictable shifts and changes in the environment, over hundreds, thousands, and millions of years.

Resources:

<http://en.wikipedia.org/wiki/Erosion>
http://en.wikipedia.org/wiki/Igneous_rock
<http://en.wikipedia.org/wiki/Lithification>
http://en.wikipedia.org/wiki/Metamorphic_rock
http://en.wikipedia.org/wiki/Rock_cycle
<http://en.wikipedia.org/wiki/Sedimentary>
http://en.wikipedia.org/wiki/Volcanic_eruption
<http://en.wikipedia.org/wiki/Weathering>
http://libraryphoto.cr.usgs.gov/cgi-bin/show_picture.cgi?ID=ID.%20Stacy,%20J.R.%20636&SIZE=medium
http://pubs.usgs.gov/gip/99/pdf/gip99_chapter2.pdf

CREATE A ROCK MODEL

INSTRUCTIONS

http://pubs.usgs.gov/of/2006/1304/YF_text.pdf

<http://schools.nyc.gov/offices/teachlearn/documents/standards/science/ms/111rock.html>

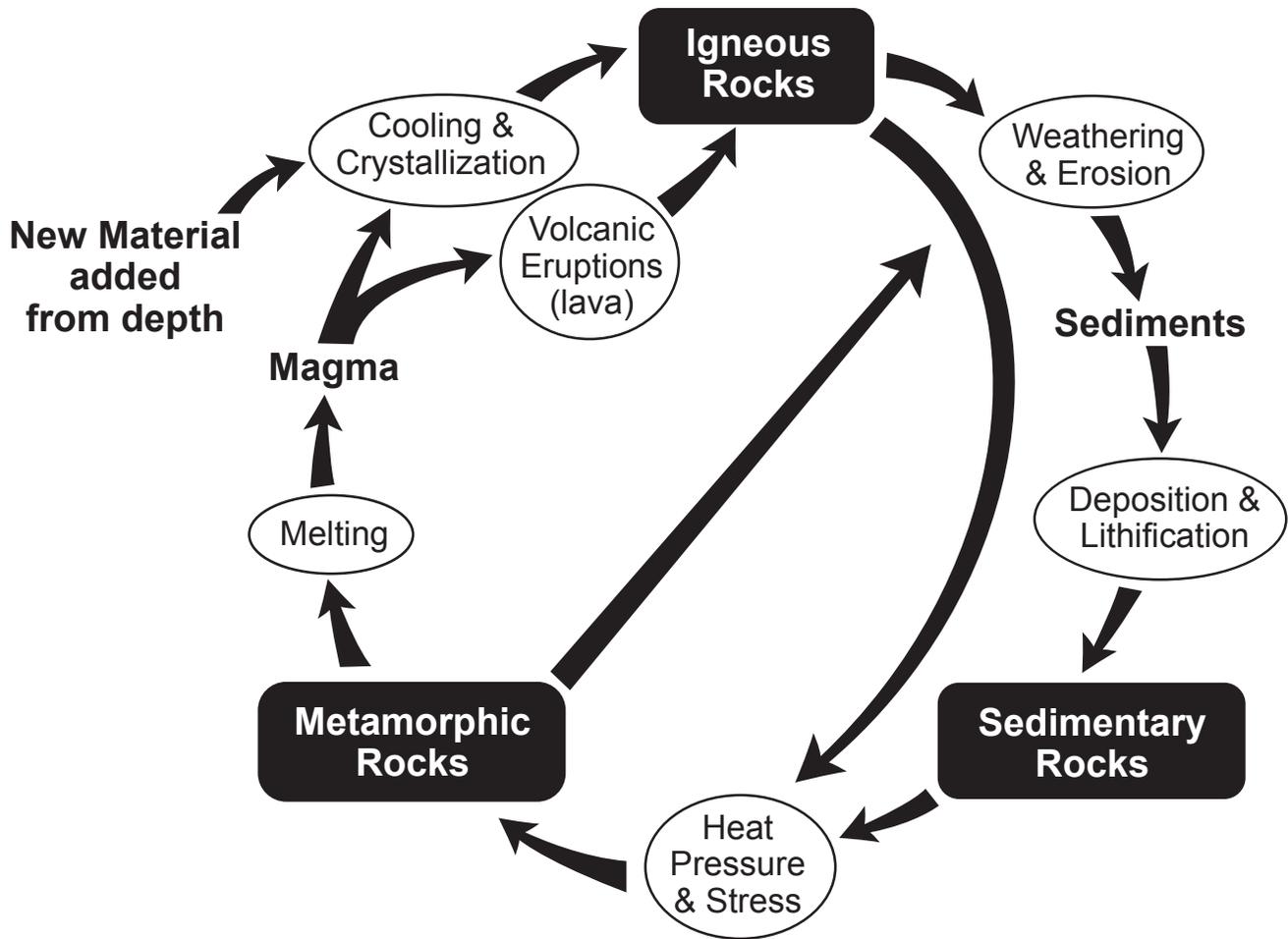
<http://volcanoes.usgs.gov/about/pglossary/rock.php>

http://www.geosociety.org/educate/LessonPlans/i_rocks.htm

<http://www.geosociety.org/educate/LessonPlans/RockCycleLab.pdf>

http://www.nature.nps.gov/views/KCs/CoastalG/HTML/03_TransDeposit.htm

http://www.usgs.gov/visitors/rocks_quiz.asp



Cooling and
Crystallization

Heat Pressure
and Stress

EROSION

Melting

Deposition and
Lithification

Volcanic Eruptions
(Lava)



Weathering

