

UNDERSTANDING IGNEOUS, METAMORPHIC, AND SEDIMENTARY ROCKS (MODIFIED FOR ADEED)

INSTRUCTIONS



Science Concept:

The rock cycle is made up of igneous, metamorphic, and sedimentary rocks.

Objectives:

The student will:

- identify six facts related to the rock cycle;
- differentiate fact from opinion about rocks in scientific inquiry; and
- create fact and opinion cards about rocks using complete sentences.

GLEs Addressed:

Science

- [6] SD1.1 The student demonstrates an understanding of geochemical cycles by exploring the rock cycle and its relationship to igneous, metamorphic, and sedimentary rocks.
- [6] SA2.1 The student demonstrates an understanding of the attitudes and approaches to scientific inquiry by identifying and differentiating fact from opinion.

Writing

- [6] W2.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms using appropriate information and structure (i.e., step-by-step directions, descriptions, observations, or report writing).

Vocabulary:

cementation - cementation is one of the processes that work together to turn sediment into sedimentary rock (lithification). Mineral-laden water percolates through sediment with open pore spaces. The spaces are gradually filled by minerals precipitating from the water, binding, or cementing, the grains together

compaction - occurs when the weight of overlying material compresses more deeply buried sediment. Along with cementation, this process converts sediments to solid rock

deposition - the accumulation of material dropped because of a slackening movement of the transporting medium, e.g., water or wind

erosion - removal of material by water, wind, or ice. As soon as a rock particle (loosened by weathering) moves, by some flowing agent such as air, water or ice, it is erosion

igneous rock - rock formed when molten rock (magma or lava) has cooled and solidified (crystallized)

melting - the process of changing from a solid to a liquid state, usually through the application of heat or pressure, or both

metamorphic rock - a rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids. In metamorphic rocks some or all of the minerals in the original rock are replaced, atom by atom, to form new minerals. Metamorphic rocks are often squished, smeared out, and folded. Metamorphic rocks do not get hot enough to melt, or they would become igneous rocks

property - a special quality of something; an attribute or characteristic

sedimentary rock - sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on Earth's surface. Sedimentary rocks often have distinctive layering or bedding

transformation - the act or process of changing in form, appearance, nature, structure, or character; to change into another form of energy

weathering - (1) the physical disintegration or chemical decomposition of rock due to wind, rain, heat, freezing, thawing, etc. (2) The response of materials that were once in equilibrium within Earth's crust to new

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conditions at or near contact with water, air, or living matter. The breakdown of rock through a combination of chemical, physical, geological, and biological processes. The ultimate outcome is the generation of soil

Materials:

- Index cards (three per student, plus one per student)
- Markers
- Masking tape
- Colored clay
- Large paper
- Poster board
- Rocks (6 or more of each type: igneous, metamorphic, and sedimentary)
- Hand lenses (one per group)
- Science journal
- OVERHEAD: "Rock Types"
- OVERHEAD: "Rock Cycle"

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process Skills: inferring, describing, and questioning

1. Display OVERHEAD: "Rock Cycle."
2. Tape a "Who am I?" card (see Activity Preparation) to the back of each student. Instruct students not to read their own card. Direct students to find a partner and choose who will go first. The person who goes first asks a yes/no question, trying to gather information on the type of rock he is wearing on his back. Partners can only answer with "yes" or "no." Partners must take turns asking questions. If a partner needs help, he can look around and read the answer, but should not give it away. Players can ask for two hints, one per turn. The hints are written on the cards. Only after asking three questions and/or hints can players guess what type of rock is on their back. Each guess takes one turn. The first one to guess the correct rock type, wins. Continue until both partners guess their rocks. Remove the cards and pass them back to the teacher who will give students a new card to continue another round of play.
3. Play one or more rounds. While students are playing, observe and listen for student understanding.
4. At end of game, ask students to record at least one characteristic of each rock type in their science journal. Use this information to group students accordingly for the Explore Activity. Record student comprehension level by rating them with either a 1, 2, or 3.
 - 1 = Weak Skills:** The student could not name at least one characteristic for each of the rock types.
 - 2 = Satisfactory Skills:** The student could name at least one characteristic of each rock type;
 - 3 = Strong Understanding of Skills:** The student could name two or more characteristics of each rock type.
5. Divide students into groups for the "Explore" activity by mixing levels of ability so that each group contains at least one student with strong skills in identifying characteristics of each of the three rock types.

Explore

Process Skills: developing models, communicating, and planning

6. Divide student into groups based on mixed levels of understanding (See Activity Procedure #5). Ask groups to choose a method to model the rock cycle (make a poster, build a shadow box, creative dramatics, write and sing a song, use clay to make a physical model) or assign them randomly. Each group should use a different method.

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7. Point out where reference books and materials are located in the classroom. Point out the OVERHEAD depicting the three rock types and the forces that transform rock from one form to another.
8. Provide students with 20 minutes to prepare their presentation. Instruct students to describe their own presentation and what they learned from their presentation and other group presentations in their science journal.

Generalize

Process Skills: *describing, communicating, identifying, classifying, analyzing data, investigating, and inferring*

9. Ask the following questions and discuss as class.
 - a. Which model was your favorite? Why?
 - b. Was there anything you didn't understand?
 - c. Was there anything missing in the model?
 - d. What would you have done differently if you had more materials or more time?
 - e. What are three characteristics of each of the three rocks?
 - f. How does a rock transform from one type to another?
 - g. What is the sequence of events in the rock cycle?
 - h. What are the different kinds of conditions that could occur for a rock to form or change?
 - i. How are igneous rocks formed?
 - j. How are metamorphic rocks formed?
 - k. How are sedimentary rocks formed?
 - l. In your opinion, which part of the rock cycle would you say is the most important?

Apply

Process Skill: *classifying, observing, communicating, collecting data, and investigating*

10. Distribute six rocks to each student. Instruct groups to sort and classify the rocks into the three rock types. Instruct students to justify their findings and explain to the class why they sorted their rocks the way they did. Instruct students to record their justifications in their science journal.



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RUBRIC

Assessment Task:

Create three "Fact & Opinion" cards, one for each rock type: igneous, metamorphic, and sedimentary. Each card should contain at least four complete sentences using correct punctuation and capitalization with no more than two errors. On each card, at least two sentences should be facts and two sentences should be opinions, describing the characteristics of each rock type.

Rubric:

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student identifies six facts related to the rock cycle.	[6] SD1.1	The student writes five or less facts pertaining to igneous, metamorphic, and sedimentary rocks.	The student writes six facts pertaining to igneous, metamorphic, and sedimentary rocks.	The student writes more than six facts pertaining to igneous, metamorphic, and sedimentary rocks.
The student differentiates fact from opinion about rocks in scientific inquiry.	[6] SA2.1	The student writes fewer than five facts and five opinions about rocks.	The student writes two facts and two opinions about the characteristics of each rock type: igneous, metamorphic, and sedimentary.	The student writes more than two facts and two opinions about the characteristics of each rock type: igneous, metamorphic, and sedimentary.
The student creates "Fact & Opinion" cards about rocks using complete sentences.	[6] W2.2.2	The student writes less than 12 sentences.	The student writes 12 sentences using correct capitalization and punctuation. There are no more than two errors.	The student writes more than 12 or more sentences about rocks using correct capitalization and punctuation. There are no errors.

Igneous

Igneous rock is formed directly from magma. There are two types of igneous rocks, intrusive and extrusive. Intrusive igneous rocks are formed when magma is trapped within Earth. The magma cools slowly because of the surrounding rock. These rocks are coarse grained. An example is *granite*. Extrusive igneous rocks, on the other hand, are formed when magma reaches the surface of Earth and cools quickly. Mineral crystals cannot grow very large during this rapid cooling, so the rocks are fine grained. Texture can vary. Examples are *pumice* and *obsidian*. Igneous rocks are the most common rocks found in Hawai‘i.



granite

pumice

obsidian

Sedimentary

Sedimentary rock is formed from sediment—pieces of other rocks that have broken into smaller particles from the action of wind, ice, or water. These particles are washed away and accumulate at



sandstone

shale

limestone

the bottom of rivers, lakes, streams, or oceans. Over time, layers stack up on top of each other. The layers are compressed and eventually turn into rock (lithify). Examples are *sandstone*, *shale*, and *limestone*. Some sedimentary rocks are formed from layers of mineral crystals or the remains of living material such as shells or plants.

Metamorphic

Metamorphic rocks are rocks that have changed into another type of rock. Metamorphic rocks can be formed from sedimentary, igneous, or other metamorphic rocks. Pressure or heat causes



marble

slate

gneiss

them to become compacted, changing them into something new. The grains in metamorphic rocks are often flattened. Sometimes the new rock looks very similar to the old rock, but sometimes the change is dramatic. Examples of metamorphic rocks are *marble* (metamorphosed limestone), *slate* (metamorphosed shale), and *gneiss* (from different rock types).

ROCK CYCLE

