# TEACHING KATE
# TEACHING KIDS ABOUT THE ENVIRONMENT

## CLASSIFICATION AND IDENTIFICATION OF ROCKS

**Grade Level: 8** **Time Required: 3 class periods**

### SC Science Standards

This lesson plan was correlated with only the grade level specified unless otherwise noted.

I. A. 1. b. 2
III. B. 3. b, c
Note: Could be taught to fit: III. B. 3. a, d, e

### Purpose

Students will learn how to classify rocks into three categories: sedimentary, igneous, and metamorphic. A dichotomous key will be used to further identify unknown samples of rocks after classifying in the initial three categories.

### Skills

Application, classification, identification, measurement.

### Concepts

Characteristics or traits of all rocks can be used for specific classification. A dichotomous key is a scientific tool to classify material in a way anyone can duplicate. A dichotomous key can be used to classify any group of items.

**Materials Needed**

Dichotomous keys for:
- igneous
- sedimentary
- metamorphic rocks

Samples of the following rocks:

| | | |
|---|---|---|
| Quartzite | Marble | Gneiss |
| Schist | Slate | Chert |
| Coal | Limestone | Sandstone |
| Shale | Breccia | Conglomerate |
| Granite | Diorite | Gabbro |
| Obsidian | Pumice | Basalt |
| Andesite | Rhyolite | |

Dilute HCl Acid
Eye Dropper

**Definition of Terms**

| | |
|---|---|
| Andesite | A normally dark grayish rock consisting mainly of oligoclase and feldspar and formed from extrusive (volcanic) processes. |
| Basalt | An igneous rock with a dense to fine grain and a dark grey to black color. |
| Breccia | A rock consisting of a fine grained matrix such as sand or clay with embedded sharp fragments. |
| Chert | Rock consisting mainly of chalcedony with smaller amounts of quartz and amorphous silica; resembles flint. |
| Coal | Solid, combustible material containing 55% to 90% carbon mixed with varying amounts of water and small amounts of compounds containing sulfur and nitrogen. It is formed in several stages as the remains of plants are subjected to intense heat and pressure over millions of years. |
| Conglomerate | A rock formed from rounded fragments varying in size from small pebbles to large boulders in a cement (such as hardened clay). |
| Diorite | A granular crystalline igneous rock. |
| Gabbro | A granular igneous rock. |
| Gneiss | A metamorphic rock comparing in composition to granite and composed of layers (foliated). |

| | |
|---|---|
| Granite | A formation of visibly crystalline, very hard natural igneous rock formed mainly of quartz and orthoclase or microcline. |
| Igneous | Molten rock that cools within the earth or on the earth's surface. |
| Limestone | A sedimentary rock formed primarily by accumulation of organic remains (shells, corals, etc.) and consisting chiefly of calcium carbonate. |
| Marble | Metamorphic rock of limestone which has been more of less crystallized. Texture may range from granular to compact. |
| Metamorphic | Preexisting rock that changes under high pressure, high temperature or chemically active fluids. |
| Mineral | Naturally occurring inorganic substance in crystal form. |
| Obsidian | Volcanic glass. |
| Pumice | A very light weight, cavity filled volcanic glass. |
| Quartzite | Compact granular metamorphic rock derived from sandstone and composed of granite. |
| Rock | An aggregate of one or more minerals. |
| Rhyolite | An acidic volcanic rock which is the lava form of granite. |
| Sandstone | A sedimentary rock usually consisting of quartz sand cemented by silica or calcium carbonate. |
| Schist | A closely foliated (layered) metamorphic crystalline rock which divides or separates along approximately parallel planes. |
| Sedimentary | Rock formed from deposited rock or mineral fragments then compacted or cemented together. |
| Shale | A rock, formed by the consolidation of clay, mud or silt, with a finely stratified structure which can be divided along natural planes of cleavage (fissile). |
| Slate | A metamorphic rock which is dense and fine grained and created by the compression of various sediments, such as clay or shale, so as to develop a characteristic cleavage. |

**Before the Session**

Before beginning the session obtain all of the rock samples and have them properly numbered for uniformity of samples. Have a copy of the dichotomous keys available for each student.

**Background Information**

Everywhere you look you will find rocks. Rocks are broken down into three main categories or classifications: igneous, sedimentary and metamorphic.

Sedimentary rock forms when rocks are weathered or broken. These rock and mineral fragments are carried and deposited by ice, wind, gravity or water. Compaction or cementation then changes this material back into rock. Ground water minerals cause the cementation. Compaction is caused by the pressure of the rock material that continually builds up on top. This type of rock looks loosely cemented together. It ranges in age from 225 million years old to the present.

Metamorphic rocks form when igneous, sedimentary or metamorphic rocks change due to the addition and/or deletion of minerals under high pressure, high temperature or chemically active fluids. These can be identified by tightly compacted layers viewed in cross-section.

Igneous rocks form when molten rock cools. There are two ways that igneous rocks form. They can either cool inside or outside the earth. The igneous rocks that cool within the earth are intrusive. Extrusive igneous rocks are those rocks that cool outside the earth's crust. Igneous, as well as, metamorphic rocks range in age from 1.2 - 2 billion years in age.

Not all of the rocks used in this lesson will be found in South Carolina, but can be found in the United States. The dichotomous keys will be a useful tool in identifying these particular rocks.

**Suggested Lesson Plan**

<u>Day 1</u>

1. Introduce students to rocks. Discuss the definitions of minerals and rocks.

2. Pass out the igneous rock samples (if there is not an adequate number for each student then pair the students with a partner).

3. Pass out the dichotomous key for igneous rocks.

4. Allow the students adequate time to work their way through the key supplying assistance as needed.

5. After the students have finished, work through the keys using the student samples to check their results. Clarify any questions that may arise at this time.

6. Collect the samples and keys at this time.

Day 2

1. Review the material from the previous day.

2. Pass out the metamorphic samples and identification keys.

3. Allow the students adequate time to identify the metamorphic samples. Give assistance as needed and answer questions as they arise.

4. After the students have finished, work through the students samples to check the students work.

5. Collect the samples and keys at this time.

Day 3

1. Review the previous days' lessons.

2. Pass out the sedimentary samples and keys at this time.

3. Allow the students adequate time to identify their samples. Provide assistance as needed.

4. When the students have finished, work through the student samples for self assessment.

5. Collect the samples and keys at this time.

Assessment

Either at the end of the third day or the following day, give each student three "unknown" samples of rock. Give each student a copy of all three dichotomous keys. Allow adequate time for the student to identify his/her samples.

**Application**

In South Carolina, sedimentary rocks occur in the Coastal Plain, igneous rocks occur in the Piedmont region, and metamorphic rocks are found in the Piedmont and Blue Ridge regions. Rocks are an important economic resource in South Carolina.

Two igneous rocks mined in South Carolina are Granite and Gabbro. Historically, granite was used for mill wheels and building. Today, it is used for building, creating monuments and as crushed aggregate for the construction industry. South Carolina granites of economic importance are the blue and pink varieties. The state stone is "Winsboro Blue Granite." Gabbro is quarried for crushed stone aggregate.

Sedimentary rocks of economic importance are Limestone and Chert. Limestone is mined mainly for crushed stone aggregate and for cement production. Past uses include: agricultural lime, mortar, lime, and sand brick; crushed stone for paving roads; and as a separating agent in indigo production. Chert is closely related to flint. Flint was important to the Native Americans as a stone of choice for the creation of tools. It was also used along with steel to "strike fire" before the advent of matches.

Gneiss and marble are two metamorphic rocks of economic importance. These are used for crushed stone aggregate.

**Extension**

The students can bring in samples of rocks from their neighborhood and try to stump their friends with their samples.

**Resources Available**

Earth Science: Discovering Science Series. 1994. Jay Windspirit. Frank Schaffer Publications, Inc.

South Carolina Minerals and Rocks. 1993. South Carolina Geological Survey.

Teaching Kids about the Environment Lesson Plans for Teachers. 1995. G. D. Kessler and L.J. Boller, Sr. Coalition for Natural Resource Education.

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## CLASSIFICATION AND IDENTIFICATION OF ROCKS

## DICHOTOMOUS KEY FOR SEDIMENTARY ROCKS

| | |
|---|---|
| 1. Rock contains grains | 2 |
| 1. Rock does not contain grains | 6 |
| 2. Rock bubbles when acid (HCl) is applied | Limestone |
| 2. Rock does not bubble when acid (HCl) is applied | 3 |
| 3. The grains are larger than sand | 4 |
| 3. The grains are not larger than sand | 5 |
| 4. The grains are round | Conglomerate |
| 4. The grains are not round | Breccia |
| 5. The grains are sand sized | Sandstone |
| 5. The grains are smaller than sand | Shale |
| 6. The rock is black | Coal |
| 6. The rock is not black | Chert |

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## CLASSIFICATION AND IDENTIFICATION OF ROCKS

## DICHOTOMOUS KEY FOR IGNEOUS ROCKS

| | |
|---|---|
| 1. Grains in rock are sand sized or smaller | 2 |
| 1. Grains in rock are larger than sand | 6 |
| 2. Rock looks like black glass | Obsidian |
| 2. Rock does not look like black glass | 3 |
| 3. Rock floats on water | Pumice |
| 3. Rock does not float on water | 4 |
| 4. Rock is dark colored | Basalt |
| 4. Rock is not dark colored | 5 |
| 5. Rock contains quartz | Rhyolite |
| 5. Rock does not contain quartz | Andesite |
| 6. Rock contains quartz | Granite |
| 6. Rock does not contain quartz | 7 |
| 7. Rock is mostly dark colored | Gabbro |
| 7. Rock is mostly light colored | Diorite |

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## CLASSIFICATION AND IDENTIFICATION OF ROCKS

## DICHOTOMOUS KEY FOR METAMORPHIC ROCKS

| | |
|---|---|
| 1. Rock is layered | 2 |
| 1. Rocks is not layered | 4 |
| 2. Rock breaks into layers | 3 |
| 2. Rock does not break into layers | Gneiss |
| 3. The grains are very small | Slate |
| 3. The grains are not very small | Schist |
| 4. Rock bubbles when acid (HCl) is applied | Marble |
| 4. Rock does not bubble when acid (HCL) is applied | Quartzite |