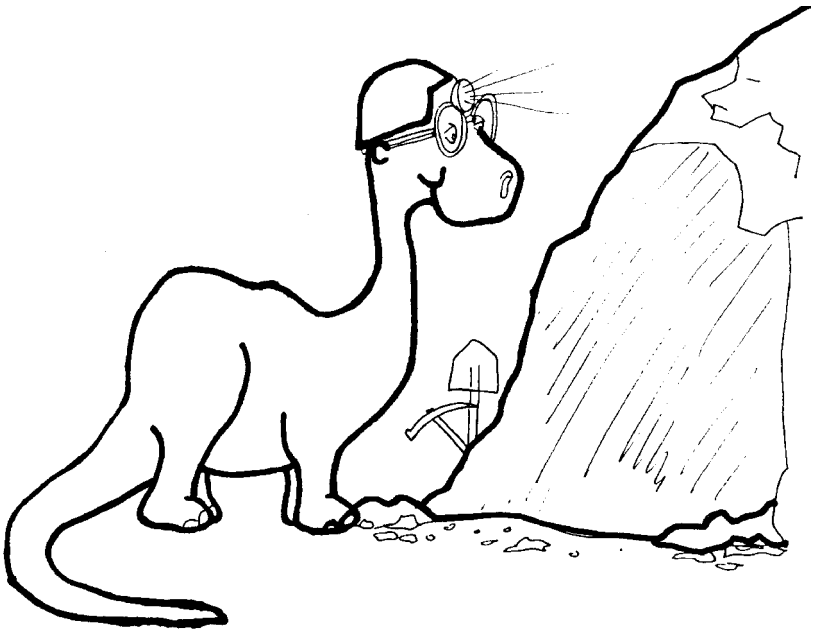
Rock Cycle

Understanding the Earth's Crust

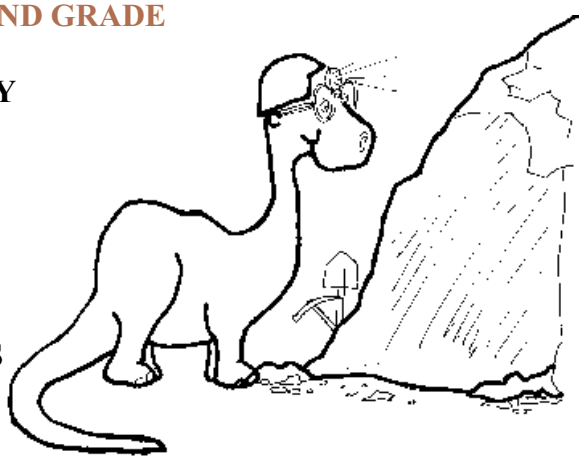
SECOND GRADE

ROCKS



1 WEEK
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF SECOND GRADE



CHEMISTRY

WEEK 1.
PRE: *Comparing the states of matter.*
LAB: *Observing the elements on the periodic table.*
POST: *Exploring the states of matter of the elements.*

MINERALS

WEEK 2.
PRE: *Observing "things" logically.*
LAB: *Comparing different minerals.*
POST: *Discovering rocks and minerals near school.*

WEEK 3.
PRE: *Observing the structure of crystals.*
LAB: *Exploring how minerals can grow.*
POST: *Designing a "mineral person."*

ROCKS

WEEK 4.
PRE: *Recognizing the three types of rocks.*
LAB: *Observing the three types of rocks.*
POST: *Writing sentences on rocks.*

PAST LIFE

WEEK 5.
PRE: *Comparing present day and fossil organisms.*
LAB: *Exploring how dinosaur footprints are formed.*
POST: *Dramatizing how different dinosaurs lived.*

WEEK 6.
PRE: *Exploring the environment of the Mesozoic.*
LAB: *Learning how fossils are made.*
POST: *Comparing how fossils appear in the literature.*

ROCK CYCLE - ROCKS (2)

PRE LAB

Students color a worksheet in order to learn where rocks form.

OBJECTIVES:

1. Recognizing the three types of rocks.
2. Comparing characteristics of different types of rocks.

VOCABULARY:

igneous
lithosphere
metamorphic
mineral
rocks
sedimentary

MATERIALS:

physiographic relief globe

The Sierra Nevada Mountains, California

BACKGROUND:

Igneous rocks come in many varieties. However, all igneous rocks began as molten rock (magma) which cooled and crystallized into minerals. Igneous rocks may look different because of two factors: (1) they may have cooled at different rates and (2) the "mother" magma (original melted rock) was of a different composition. Variations in these two factors have created many different types of igneous rocks. When the magma cools at different rates, it creates different sized minerals. Quick cooling magmas have small minerals (with the exception of obsidian, which is actually composed of silica, but has no crystalline structure). Basalt, for example, has small minerals, most of which can only be seen under a microscope. Magma that cools slowly creates rocks like granite which have large minerals that can be seen with the naked eye. Geologists classify igneous rocks based on both their crystal size and composition. The Rock Cycle has its origin in Igneous Rocks.

Sedimentary rocks form at the Earth's surface in two main ways: (1) from clastic material (pieces of other rocks or fragments of skeletons) which have become cemented together, and (2) by chemical mechanisms including precipitation and evaporation. Sedimentary rocks are usually associated with liquid water (which facilitates erosion, transportation, deposition, and cementation). However, sedimentary rocks may also form in dry, desert environments or in association with glaciers.

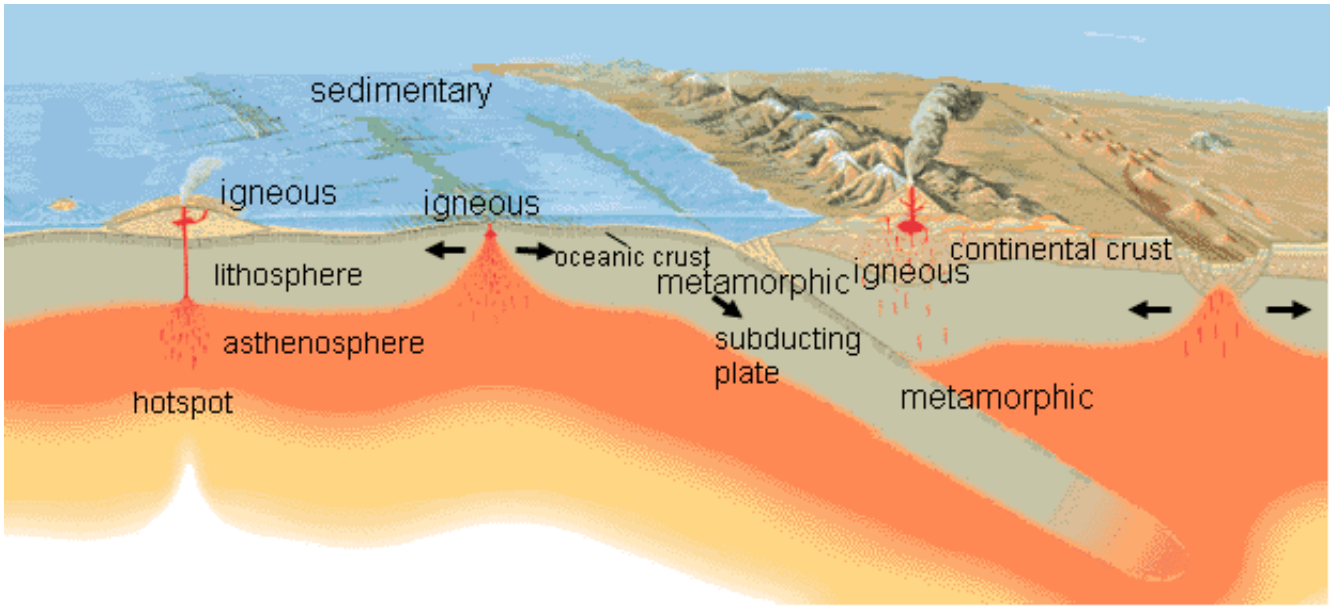
Metamorphic rocks are igneous, sedimentary, or preexisting metamorphic rocks that

have been changed by great pressures and temperatures within the crust and upper mantle of the Earth. The temperatures were not enough to melt the rock, otherwise, an igneous rock would have formed. The pressures were much greater than those required to simply break the rocks into pieces. They were high enough to change the chemical make up of the rock by forcing the elements in it to "exchange partners."

All three types of rock make up the Earth's lithosphere, the outermost layer. The lithosphere averages about 100 kilometers in thickness. It is like an eggshell compared to the Earth's total radius (the distance from the Earth's core to the surface). The lithosphere is solid rock. Sedimentary rocks are the most abundant rock only on the surface of the Earth, but igneous and metamorphic are abundant deeper into the mantle.

PROCEDURE:

1. Introduce the students to the lithosphere. Ask them where most of the rocks that we see on the surface of the Earth were created. Explain why the lithosphere is the correct answer. Show them a cross-section of the Earth by showing them the physiographic relief globe. They will be amazed at how thin the lithosphere is compared to the rest of the Earth. Explain that igneous, sedimentary, and metamorphic rocks are created in the lithosphere. Briefly distinguish between the lithosphere, hydrosphere, and the atmosphere. Lithosphere is sphere of rocks; hydrosphere is sphere of water; and atmosphere is Earth's enveloep of gases.



2. Write the following on the board:

IGNEOUS ROCK = hot rocks or melted rocks (ask students to think of hot areas) are found:

- volcanoes
- inside the Earth (not near the center, more toward the outside, within the crust)

SEDIMENTARY ROCKS = cool, wet, or fossil rocks (ask students to think of water) are found:

- rivers
- oceans
- lakes

METAMORPHIC ROCK = changed, squished, or "rhinestone" rocks (ask students to think of squishing) are found:

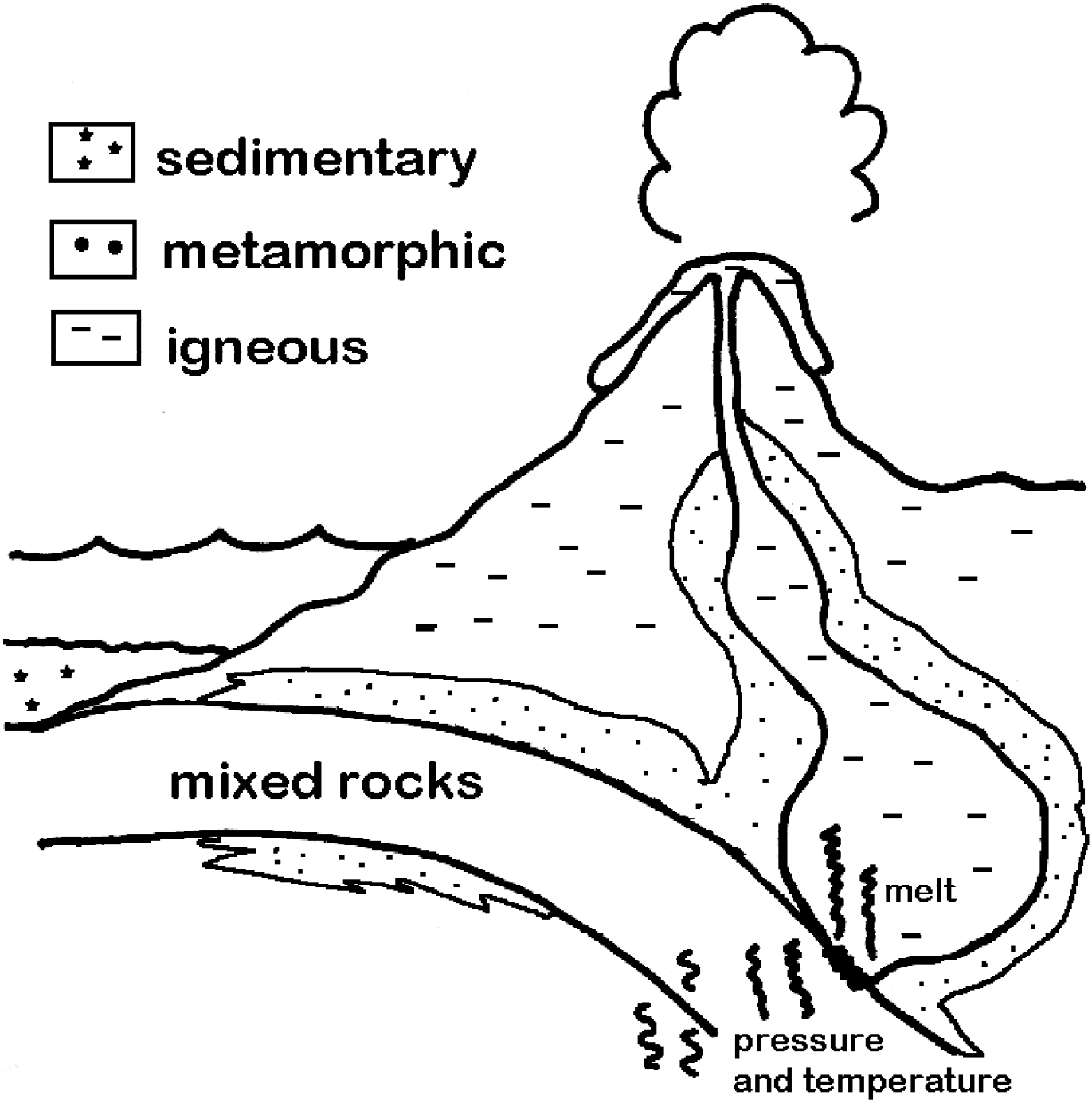
- inside the Earth (not near the center, within the lithosphere and upper mantle)

3. Give students the worksheet and color the appropriate rock types. Make sure students understand how to use a map legend.

ROCK CYCLE - ROCKS (2) PRE LAB

THREE TYPES OF ROCKS

Color the diagram below. Use the legend to select colors.



ROCK CYCLE - ROCKS (2)

Students describe rock samples.

LAB

OBJECTIVES:

1. Observing the three types of rocks.
2. Comparing rocks.

Mudstone with fossils

VOCABULARY:

flat
grain
light (weight)
shiny
smooth

MATERIALS:

Rock Cycle - Rocks (2)
red, yellow, and black paper

BACKGROUND:

The name of a rock reflects certain characteristics. For example, obsidian will resemble glass and scoria will usually be dark red with holes. Rock names also refer to a texture. For example granite will have interlocking minerals and sandstone will have a gritty, sandy feel.

Young children need to experience these characteristics before they can internalize the name of a rock. They need to describe and compare the characteristics, as they learn the rock's name. Just knowing a name of a rock is not enough. In this lab, students will use their observational skills to classify rocks. Rather than using a formal classification, the emphasis is on students developing their own criteria for rock classification.

PROCEDURE:

1. Review the three main groups of rocks with students. Be sure to tell them that there are many different types of rocks within each of the three groups. Brainstorm possible terms for describing rocks with the students.

2. Explain that identification and classification of an individual rock specimen is based on a variety of characteristics and criteria, and that they will start to learn some of these in this lab.

3. Give each group of students a piece of red, yellow, and black paper. Write red = igneous, yellow = sedimentary, and black = metamorphic on the board. Pass out the rock sets. Go through each of the rocks to make sure the students put the correct rock on the right color. Use the information on each rock as outlined below. You may want to give the students some clues of each rock, and then when you review the lab, you might want to add more information.

IGNEOUS

OBSIDIAN - Also known as volcanic glass. Most children recognize obsidian as the rock that many Indians used to make arrowheads. The Indians chose obsidian for the same reasons that a geologist can recognize it. It is very hard, but more importantly it breaks into sharp edges that easily cut through many materials. Note that broken obsidian looks like broken glass. Obsidian occurs in almost any color, depending on what trace elements are present in it. Black and brown obsidian are most common. Obsidian is an amorphous solid; that, it is a solid rock composed of silicon dioxide, but this material lacks crystalline structures. It is one of very few exceptions to the rule that rocks are made of minerals.

The obsidian that is in your kit comes from volcanoes near Clear Lake, California. Obsidian is formed when lava is cooled very quickly; it freezes before crystals can form. Have your students try to determine which part of a lava flow will cool quickly enough to form obsidian (answer - the outer surface or “skin” of the flow).

PUMICE - Students will immediately notice that pumice is spongy or “full of holes.” This characteristic makes pumice extremely lightweight; it even floats in water (you may wish to show this to your students). It is commonly light gray to blackish-gray in color. It is easily broken and has sharp edges. Like obsidian, pumice is volcanic glass; it thus looks glassy (especially with a magnifying glass) and lacks visible minerals.

Pumice forms during eruptions of magma containing large quantities of gasses, such as water vapor, sulfur dioxide, and carbon dioxide. The gas "froths" the magma as it erupts, forming bubbles. This is physically analogous to opening a soda can; carbon dioxide bubbles form in the drink as the can is opened. Like obsidian, the magma then cools quickly, preserving the bubble shapes. The gas often escapes, leaving numerous holes in the pumice. Pumice is used as an ornamental building stone. “Pumice rock" is also sold in beauty stores for cleaning dead skin cells.

SCORIA - Scoria is composed of volcanic glass and preexisting rock fragments that became incorporated into the magma as it erupted. The volcanic glass looks similar to pumice, but is reddish in color, because it contains more iron than pumice. Scoria lacks large visible minerals; small ones may be visible with a magnifying glass. Scoria is often sold as “lava rock” for use as a landscaping material.

GRANITE - Granite is composed of visible minerals, most commonly quartz, mica and feldspar. Quartz looks clear and glassy, mica is black and flaky, and the feldspars (commonly two or more different types are present) are either pale pink/orange or white in color. The relatively large size of the minerals indicates that the magma that formed the granite cooled slowly. This took place deep inside the earth, not on the surface, like

pumice or scoria; it is a plutonic rock. Ask your students if they think granite is made of the same minerals as basalt (no, they cooled differently and came from a different "mother" magma). It may help to have them imagine that the minerals in the granite were tiny; would this make them dark?, (No, they would still be light colored). This indicates that rocks composed of different minerals likely have different magma “mothers.” Try using the analogy that rocks are like people, no two are the same! Granite is used as ornamental and building stone.

SEDIMENTARY

CONGLOMERATE - Conglomerate consists of pebbles, gravel, sand, and boulders that have been cemented together to make a solid rock. These materials were mixed naturally in rivers or in some parts of oceans and lakes. Any type of preexisting rock can become part of a conglomerate.

To explain cementation, try telling students that Mother Nature has a cement that she sometimes pours onto the beaches of lakes, oceans, and rivers. When it hardens, it becomes conglomerate, if the pieces are big, or sandstone, if they are small. In reality, the two most common cementing substances are natural solutions of calcium carbonate and silica dioxide. Crystals of calcite and quartz, respectively, precipitate from these solutions in the spaces between grains, cementing the rock together.

SANDSTONE - The gritty feel of the surface of sandstone hints that this rock was once sand that has been cemented together. Sandstones have quite varied compositions; some are composed entirely of quartz, and others are mixtures of rocks, crystals and fossils. Almost any combination is possible. Sandstones thus come in a wide array of colors. By definition, the grains in a sandstone are “sand-sized”; most students will recognize this if you demonstrate "sand size” by showing them a bag of sand.

SHALE - Shale is composed of very small particles of mud, which have been compacted and cemented together. Individual mud grains are very small; they will rarely be visible. Shales are quite variable in color.

CHERT - Chert is red to brown in color and is largely composed of very small quartz crystals. The red color comes from trace amounts of iron, and brownish tinges can be caused by the presence of organic matter. Chert is very hard. Chert was also used by Indians (the variety called flint) for making tools. Chert forms from the skeletons of microscopic one-celled protozoa called radiolarians. These are sometimes preserved in the rock, but can only be seen with a microscope. Chert forms on the ocean floor, where the skeletons of these organisms are deposited after they die.

MUDSTONE WITH FOSSIL SHELLS - Mudstone is a variety of shale. The samples in the kit contain marine fossils, indicating that these rocks formed in the ocean.

METAMORPHIC

MARBLE - marble is composed exclusively of large commonly visible crystals of calcite. The gray/white bands in some of the samples are due to impurities within the calcite. Marble actually comes in a variety of colors, including black, gray, white, and pink.

Marble, like all rocks that have calcite in them, fizz if you put a weak acid on it (usually 10% solution of hydrochloric acid). Marble forms when a rock containing calcite in it (such as limestone) was put under high temperature and pressure conditions. Marble has been used throughout history because it is easy to break and to carve. Some marble (especially in Italy) is noted for its smooth, small crystals that make it excellent for statues. Many of the statues of Michelangelo were made from marble. Marble is also used as an ornamental building stone. If you live near or in a city, have your students try to find buildings made of marble. If you are in an old school, some of the bathroom stalls or floors may be made of marble.

SERPENTINITE - Serpentinite has a smooth, soapy feel, a green mottled color, and a somewhat flaky texture. It is composed mainly of the mineral serpentine. Serpentinite is so named because of its mottled color, which resembles the back of a sea-serpent. The geologic origin of serpentinite is still debated, but many scientists agree that it formed from a rock like basalt that was put under high temperature and pressure. Serpentinite is the state rock of California. Serpentinite is used for carving and as an ornamental building stone.

SCHIST - Schist is composed of visible minerals, mostly micas. Schists form under moderately high pressure conditions; this causes the naturally platy mica crystals to line up, giving the rock a platy look. This is a good example for illustrating the characteristic "squished" look of metamorphic rocks to your students. Have them imagine that a heavy Mother Nature sat on some rocks - look at what she did!

ROCK CYCLE - ROCKS (2) LAB

PROBLEM: Can you identify rocks with a few characteristics?
PREDICTION:_____
PROCEDURE: See if you can match the rocks with the information given below. Add one more characteristic about the rock, so that the next time you see this rock it will be easier to identify. Place all igneous rocks on red paper, sedimentary on yellow, and metamorphic on black.

IGNEOUS		
CHARACTERISTIC	NAME OF ROCK	LIST ONE MORE
BLACK, GLASSY	OBSIDIAN	
HOLES, RED	SCORIA	
BLACK AND WHITE	GRANITE	
LIGHT	PUMICE	

SEDIMENTARY		
CHARACTERISTIC	NAME OF ROCK	LIST ONE MORE
BROWN, SMALL PIECES	SANDSTONE	
LARGE PIECES	CONGLOMERATE	
FLAT	SHALE	
SHELLS, MUD COLORED	MUDSTONE WITH FOSSILS	
HARD, REDDISH BROWN	CHERT	

METAMORPHIC		
CHARACTERISTIC	NAME OF ROCK	LIST ONE MORE
GREEN, SMOOTH	SERPENTINITE	
GRAY, SHINY, FLAT MINERALS	SCHIST	
WHITE, GRAY	MARBLE	

CONCLUSION: Can you now identify rocks? Why? What have you learned?
_____

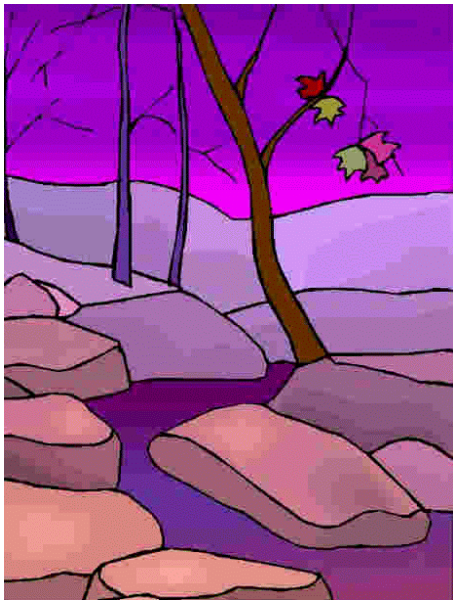
ROCK CYCLE - ROCKS (2)

POST LAB

Students write sentences about rocks.

OBJECTIVES:

1. Writing sentences on rocks.
2. Developing a story about rocks.



VOCABULARY:

igneous
metamorphic
sedimentary

MATERIALS:

worksheet

BACKGROUND:

Writers often use images in order to get a point across to their readers. Phrases like ”blue like the sea, green as the grass, red as blood” are examples. Some writers have even used rocks to convey these images. Hard as a rock is probably the most common example. During the lab the students examined and identified 10 rocks, which had a wide variety of characteristics. In this exercise, they will develop sentences that describe some of these identifying features. The objective is for children to use characteristics of a particular rock as descriptive terms.

PROCEDURE:

1. Review the names of the rocks studied in the lab exercise.

2. Next, have the students fill out the worksheet by creating sentences that go along with each of the phrases.

3. Below are some suggestions on what the children may write. You may have to help them along if they have never done an exercise like this.

RED AS SCORIA

My sister fell down and her knee is as red as scoria.

WHITE AND BLACK LIKE GRANITE

If you mix salt and pepper it looks white and black like granite.

GLASSY LIKE OBSIDIAN

The bottle broke and was glassy like obsidian.

GRAINY LIKE SANDSTONE

The sand paper was grainy like sandstone.

FLAT AS SHALE

He stepped on the hat and it was as flat as shale.

SMOOTH AS SERPENTINITE

The furniture was smooth as serpentinite.

SHINY AS SCHIST

The dress she wore to the party was shiny as schist.

GRAY LIKE MARBLE

When Harry saw the accident, his face was gray like marble.

ROCK CYCLE - ROCKS (2) POST LAB

WRITE A SENTENCE THAT USES THE CHARACTERISTICS OF THE FOLLOWING ROCKS TO DESCRIBE A PERSON, PLACE, OR THING.

RED AS SCORIA

_____

_____

WHITE AND BLACK LIKE GRANITE

_____

_____

GLASSY LIKE OBSIDIAN

_____

_____

GRAINY LIKE SANDSTONE

_____

_____

FLAT AS SHALE

_____

_____

SMOOTH AS SERPENTINITE

_____

_____

SHINY AS SCHIST

_____

GRAY LIKE MARBLE

_____

_____