Part One
Rocks and Minerals

Grade Level: 1

*** Part One is actually a unit plan and contains more than one lesson. You can pick and choose those that best fit your goals and the ability level of your students.**

Purpose: While rocks may seem like dull, lifeless forms, it is important for everyone to understand the importance of rock to our world. Rocks and minerals are used every day by people in such things as glass windows, metal kitchen appliances, wallboard, and concrete for our driveways and sidewalks. We wear rocks in our jewelry. Minerals are in most of our foods. Rock form the basis for our earth. The hardness of the rock under an area determines whether the area is good for agriculture as softer rock breaks down and after time mixes with debris and minerals to create rich soil. Where we find large concentrations of minerals, we have good mining areas. Even our scenery depends on the formations of rock to make jagged mountains, the flat plains of the Midwest, and sandy beaches. Erosion and weathering play a role.

Suggested Goals: This unit will enable the student to:

1. Verbalize the difference between rocks and minerals and make models that will enhance learning about both.
2. Differentiate between the three different kinds of rocks and give examples of each.
3. Verbalize three different ways the earth changes.

Targeted Objectives for Rocks and Minerals:

1. Students will verbalize or write the definition for a mineral and a rock.
2. Students will verbalize or write the differences between a rock and a mineral.
3. Students will write short sentences listing, or draw pictures illustrating, the three types of rock telling how each rock is formed.
4. Students will gain an increased amount of knowledge about rocks and minerals by doing investigations on rocks and minerals.
5. Students will demonstrate their understanding of rocks and minerals by keeping a science journal recording investigations and what they learned from each investigation.

Minerals

A mineral is a chemical element or compound found the earth.

1. It occurs naturally.
2. It is inorganic (not made from living things).
3. It has a definite chemical composition, meaning that it contains the same elements in the same proportions.
4. It has a crystalline structure (atoms are arranged so they form a particular geometric shape.

Minerals have definite physical properties, which can be tested. These include luster, hardness, streak, color, specific gravity (relative density), rupture (cleavage and fracture), transparency, magnetism, and reaction to hydrochloric acid.

A mineral's color depends on what's mixed with it. Some minerals have metal with a metallic luster mixed in with them that causes them to shine. Minerals that don't contain metals can look dull.

Geologists are interested in crystals because they tell them about the internal structure of minerals. You can investigate crystals in the classroom to better appreciate what they are. Students should be encouraged to investigate various rocks that have a well-defined crystalline structure. Students may have their own crystals that they can share with other classmates. Making models of the different crystalline shapes allows children to observe up close the six different structures. Vary the investigations that follow to change the different substances creating the crystals. Vary the temperature at which they are allowed to develop. Vary the containers that you use to grow crystals. Children should brainstorm conditions in nature that affect crystals in similar ways as those in their experiments.

Investigation 1—Growing Crystals

Materials
Glass jar (ex: empty mayonnaise jar)
Hot water
Salt (or alum, Epsom salts, cream of tartar)
Cardboard
String
Pencil
Nail

The beauty of rock crystals fascinates children. They will be excited to learn that they can create their own crystals, and it is quite easy to grow these. No two crystals will be the same in appearance. They will require some time to grow. They also need the correct solution and temperature to mature into beautiful shapes. The rate of cooling will affect how the crystals grow. Solutions cooling slowly form large crystals compared to similar solutions cooling quickly.

Fill a glass jar with hot water. Add salt as long as it keeps dissolving. (Try other mixtures of alum, Epsom salts, or cream of tartar.) Tie a string to a pencil or through a hole in a square of cardboard for better stability. Make the string just long enough to reach the bottom of the jar. Weight the end of the string with a nail or a bolt. Drop the string into the solution. Place the jar in a protected, warm place where it can cool slowly. Observe the salt solution each day. Each child should record his observations in a science journal by drawing a small picture and writing a few short sentences about what they observe.

**As a quicker alternative to the above crystal growing investigation, you can use the following – taken from the Mrs. Stewart's Bluing Web site (http://www.mrsstewart.com/pages/msbframe.htm):

Materials
Plastic bowl
Charcoal briquettes
Water
Salt
Mrs. Stewart's Bluing
Food coloring

In a glass or plastic bowl, put some pieces of coal, coke (charcoal-like substance), charcoal, porous brick, tile, cement or sponge.

Day 1: Over the base material, pour two tablespoons of water, two of table salt (iodized or plain) and two of Mrs. Stewart's Bluing.
Day 2: Add two more tablespoons of salt.
Day 3: Pour into the bottom of the bowl (not directly on the base material) two tablespoons each of salt, water, and Mrs. Stewart's Bluing, and then add a few drops of mercurochrome, vegetable coloring or ink to each piece.

By this time a beautiful flower-like growth should have appeared. If all the conditions are not ideal, it may be necessary to add two tablespoons of household ammonia to aid the growth. A free circulation of air is necessary, and these formations will develop better where the air is dry.

To keep it growing: Add more MSB, salt and water from time to time. It will "bloom" indefinitely into beautiful rosebuds, coral and crystal. Try it!

Investigation 2—Rock Candy

Materials
2 glass jars (or small bowls)
Aluminum pan
Cup measure
Water
Sugar
Food coloring

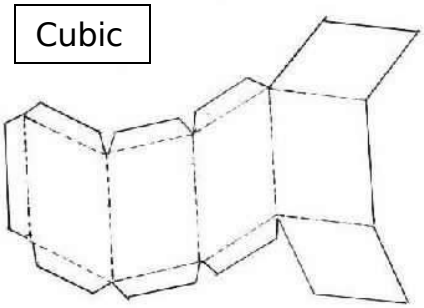
Put one cup of sugar into a cooking pot. Add ½ cup of water, but do not stir the mixture. Boil over high heat for one minute without stirring. Add a few drops of food coloring as the mixture boils. Pour the mixture into one or two glass jars or small bowls. Let the containers sit undisturbed for about two weeks. Check the candy every day. If a crust forms on the surface, break the crust so the water can continue to evaporate. When the crystals are large enough, break the candy from the bowl with a table knife, and eat your sweet treat!

Art Project—Crystal Models

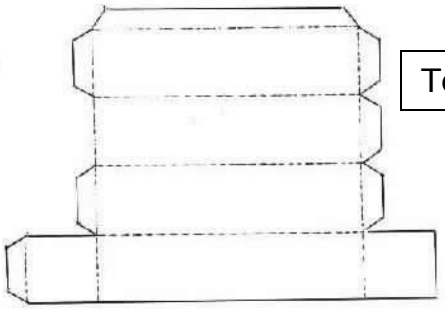
Materials
Enlarged shapes (on a standard Xerox machine, enlarging to 142% four times gives a good size for first graders to handle)
Construction paper
Glue
Glitter
String

Using enlargements of the patterns below, students will fold carefully on the dotted lines and glue the models together. These can be made from different colors of paper, or children can color and decorate the sides before they glue them. Glitter adds glitz to these models and makes them sparkle like true crystals. By using the correct names for each crystal model, children will become more familiar with correct terminology. These can be hung or made into mobiles by poking a small hole through them with a needle with string attached.

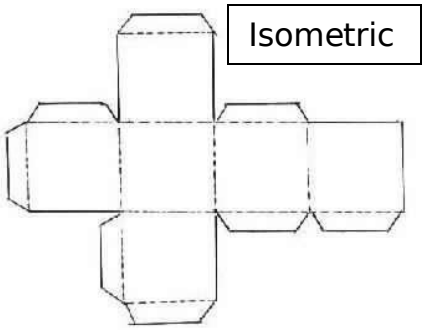
Cubic



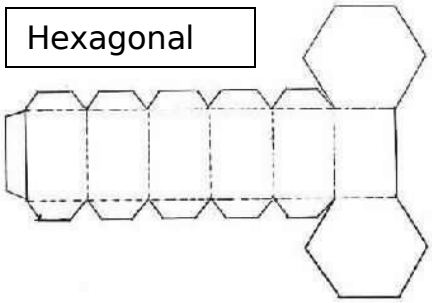
Tetragonal



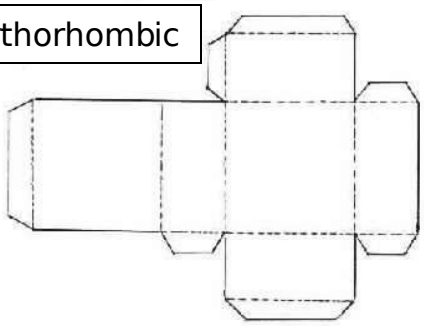
Isometric



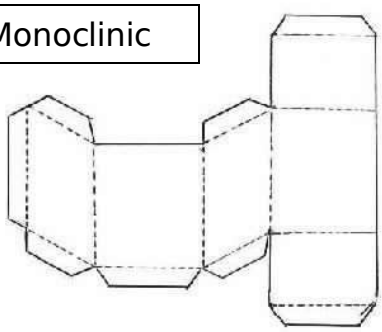
Hexagonal



Orthorhombic



Monoclinic



Observation—Coffee Can

Materials
1 lb. Coffee can w/ plastic lid
Socket
Lamp cord
Light bulb
Crystals or transparent objects

A light source enhances the beauty of crystals. Using a one pound coffee can, remove the lids from both ends. Keep the plastic lid on one end. Under the can, place one light socket, a lamp cord, and a 40 or 60 watt light bulb, and plug it in. It is wise to punch many pinholes in the plastic lid for cooling. You can place crystals or any transparent object on the plastic lid for viewing. Observe sizes, colors, and shapes.

Art Activity—Sparkle Designs

Materials
Water
Construction paper
Paintbrushes
Table salt

Using water and paintbrushes, children will paint designs on brightly colored construction paper. Using salt from a salt shaker, the children will sprinkle the wet areas heavily with salt. Shake off the excess salt and the children will have a beautiful design with sparkle and texture. Use black or blue paper to create a frosty scene during the winter.

Rocks

Minerals by themselves are not the whole story, since they usually combine to form masses of rock. These larger combinations determine how our planet's crust looks and behaves. Rocks are combinations of various minerals that have been formed by heat or pressure in the earth. Using his knowledge of how rocks are formed can give a geologist a good idea of what that part of the earth was like in earlier times.
There are three groups of rocks—igneous, sedimentary, and metamorphic. Each of these groupings includes different varieties of rocks that were created in very different ways.

Igneous Rock

Igneous means relating to fire. Rocks of this group come into being when molten rock, known as magma, cools into a solid state. When magma moves to a cooler area, either under the ground or by breaking the surface as lava, it begins to harden. Magma that hardens under the surface of the earth is called intrusive rock and includes granite and gabbro. If you remember from earlier investigations, crystals that formed under warmer temperatures grew more slowly and got larger, so both of these rocks have crystals that can be seen with the naked eye. Magma, in the form of lava, sometimes does make it all the way to the earth's surface through volcanic vents. As the lava cools it becomes extrusive rock. One example of extrusive rock is rhyolite. It is the extrusive equivalent of granite. They are easily distinguished, however, as rhyolite is finely textured, with smaller individual crystals that can be seen only under a microscope. Obsidian is another example of extrusive rock. It also has very small crystals that can be seen only under a high-powered microscope.

Observation of Extrusive and Intrusive Rock

Materials
Pumice – a number of pieces
Granite – a number of pieces
Magnifying glasses

You will need to gather two common rocks for this observation. Pumice stones can be found in most drugstores. It is also used in landscaping, as it is a lighter stone to carry through the yard. Pumice is ejected from a volcano during an eruption. It forms from the frothy scum on a lava flow that has bubbles trapped in it and is a very light rock. Pumice is extrusive rock. Granite is a very common rock that you probably already have in your collection. Granite is an intrusive rock. Because it has cooled slowly in the crust, it has very coarse grains. Granite can be different colors depending upon which minerals were mixed to make it. Students will look at and compare the differences of the rock samples with a magnifying glass. Students will record their findings in their science notebook.

Investigation—Toothpaste

Materials
Tube of toothpaste
Thick needle

Have the children pretend that the toothpaste is magma. Since magma is a thick liquid, the toothpaste should move much like the toothpaste in a tube that is not very full. Squeeze all the toothpaste into one part of the tube. Can the children predict what will happen if you press down on the part where all the toothpaste is? Press on that part. What do they observe? Were their predictions correct? Would this be like intrusive or extrusive rock? Have the children predict will happen if the toothpaste (magma) comes to a weak spot in the tube. This would be similar to a vent in a volcano or the earth where the magma is able to come to the surface of the earth. Make a hole in the tube with a pin and observe if their predictions are correct. Ask children to brainstorm ways to make the toothpaste come out more quickly. Brainstorm with children other materials they could use to do this investigation.

Art Activity—Make Rubbings

Materials
Crayons (three to four colors)
Paper
Access to the sidewalk

Sweep a small area of concrete clean. Choose three or four colors of crayon or colored pencil that you can see in a piece of granite. Lay a paper flat on the concrete and make a rubbing lightly with the first color. Move the paper slightly and rub again with the next color. Repeat this process with the third color. Use your rubbing to decorate the covers of your science journal.

Sedimentary Rock
Nature has a way of making sediments each and every day. Dust blowing through the air and landing on your doorstep is sediment. A rock that a child has thrown that chips as it lands is sediment. Most sedimentary rock is formed under water. Rocks get bumped along as the current in a river chips off the rough edges. Dirt from the riverbank or runoff from fields carries soil particles into streams and rivers. Some of this sediment travels great distances before it eventually settles to the bottom of the river or is carried out to the ocean. How can all these particles turn into rock? The process may take millions of years as more sediment piling on top slowly buries sediment. As the pile gets heavier, the particles near the bottom are squeezed closer and closer together and warmed by the heat of the earth. Groundwater brings new minerals that act like cement to bond the particles together into sedimentary rock. Another kind of sedimentary rock is formed when skeletons of tiny animals called plankton fall to the bottom of the ocean. Shells from bivalve animals and crustaceans also add to this collection on the ocean floor. Again, the heaviness of the water and the piling up of the debris causes a great squeezing pressure that changes the sediment into hard rock. Minerals that are dissolved in the water help to cement the sediment together. Sedimentary rocks are often formed in layers as more and more sediment falls on top of older layers.

Investigation—Pressure on a Marshmallow

Materials
Marshmallows
Clear Cylinder
Cardboard
Weights (fishing tackle weights would work)

Stack six or seven marshmallows in a thin, clear cylinder. Cut a cardboard circle to fit inside the container on top of the marshmallows. Place heavy weights on the disc. Children should observe the marshmallows. Did the marshmallows begin the same size? Are they the same size after weights were placed on the stack? What caused the change in size? Children should record the investigation and their findings in their science notebook.

Making Sandstone

Materials
Cup
Epsom salts
Water
Sand

Note: You may have to practice a bit to get just the right mixture.

Dissolve 2 ½ teaspoons of Epsom Salts in 1 ½ inches of water in a cup. Keep stirring until the salts have dissolved. Put 1 ½ inches of sand in the cup. Stir until it is well mixed. The salt will act as cement that will glue the particles of sand together. Let the mixture set up for about an hour. Check to pour off liquid that has risen to the top. You may have to remove excess liquid several times. After a week, peel the paper cup away. The mixture still may need a little more time to dry, but you see sandstone.

Testing for Limestone

Materials
Beakers (or jars)
Several rock types
Vinegar

One very common sedimentary rock is limestone. It is made from shells that have fallen in the ocean. Because of this it contains a large amount of calcium. Calcium reacts with vinegar and makes bubbles of carbon dioxide.

Have children drop several types of rocks in vinegar to determine which would be limestone. Children should record their findings in their science journal.

Activity—Layered Sandwiches

Materials
Bread
Knife
Peanut butter
Jelly
Paper plates

Children will lay one slice of bread on a plate. Use a knife to spread a layer of peanut butter on top of the slice of bread. Add a layer of jelly on top of the peanut butter layer. Place the second slice of bread on top of the jelly layer. Eat the sandwich. Discuss how the layering is similar to sedimentary rock. This is a very good topic for students to add to their science journals as they are so familiar with peanut butter sandwiches and is easy for them to make comparisons. Included in this should be a listing of various materials that could be found to make up the layers of a sedimentary rock. Extra credit should be given for including the point that dissolved minerals are the glue that cements the sediments together.

Metamorphic Rock
Metamorphism is the change in structure, appearance, and composition of a rock in the solid state within the Earth's crust-- a result of changes in temperature, pressure, and/or chemical interactions. In nature, great pressure on rocks causes the temperature to rise. Together, the heat and pressure changes produce metamorphic rock. Metamorphic rocks begin as an igneous or sedimentary rock. Metamorphic rock does not melt, like igneous rock. These are actually baked by the earth's internal heat causing the structure to change altogether. Rocks may begin to change even at very shallow depths. Much of the world's metamorphic rock was formed billions of years ago when the earth was much hotter and there was much more tectonic activity causing great pressure on rocks.

Investigation—Smash

Materials
Paper
Heavy book

Each child will need to loosely wad up ten small pieces of paper. Children will place a book on top of these and press down hard on the book. This should demonstrate that the pressure being exerted on the wads would flatten them. In nature, the weight of rocks at the surface pushes down on rock and dirt

beneath, forcing them to flatten into layers. Children will record their findings in their science journal.

Activity—Baking Chocolate Chip Cookies

Materials
Recipe for chocolate chip cookies
Ingredients
Paper plates

Students will list the ingredients to be used in their cookies. Point out to children that each of these ingredients are complete things when they are added to the mixture and allow children to observe the physical characteristics of each ingredient. Mix these ingredients together. Point out that although the ingredients have changed their appearance somewhat in the mixture, the moisture comes from the eggs and vanilla. The chocolate chips still look the same and the flour is the glue that is holding the mixture together. Children should observe the mixture carefully. Bake the cookies. Although the mixture has not changed, the product is quite different after the baking process. Children should brainstorm together how metamorphic rock is similar to this activity. Children will record their observations in their science notebook.

Note: You could have the students take apart some of the cookies – sorting by ingredients and comparing how the ingredients blended in different ways in different cookies.

Assessment of Rocks and Minerals

1. Children will write a short definition of a mineral and list as many minerals as they can.
2. Children will write a short paragraph listing as much as they know about crystals.
3. Children will write a few short sentences listing the three types of rocks and how each was formed. They should list as many rocks as they can that would fit each category.
4. Science journals should be collected and graded according to the description of the investigations and learning derived from these investigations.
5. There are rubrics that can be adapted for your use in any of the above activities. Check out these sources:
   http://www.stclair.k12.il.us/services/scilit/hlsticrb.htm
   http://www.col-ed.org/smcnws/scientific.html

Illinois State Board of Education Goals and Standards:

3.B.1a: Use prewriting strategies to generate and organize ideas (e.g., focus on one topic; organize writing to include a beginning, middle and end; use descriptive words when writing about people, places, things, events).
3.C.1a: Write for a variety of purposes including description, information, explanation, persuasion and narration.
5.C.1a: Write letters, reports and stories based on acquired information.
11.A.1a: Describe an observed event.
11.B.1b: Design a device that will be useful in solving the problem.
11.B.1d: Test the device and record results using given instruments, techniques and measurement methods.
12.D.1a: Identify examples of motion (e.g., moving in a straight line, vibrating, rotating).
12.D.1b: Identify observable forces in nature (e.g., pushes, pulls, gravity, magnetism).
12.E.1a: Identify components and describe diverse features of the Earth's land, water and atmospheric systems.
13.A.1c: Explain how knowledge can be gained by careful observation
26.A.1e: Identify media and tools and how to use them in a safe and responsible manner when painting, drawing and constructing.
26.B.1d: Demonstrate knowledge and skills to create visual works of art using manipulation, eye-hand coordination, building and imagination.



Print Resources

National Wildlife Foundation. 1989. *Geology—The Active Earth*. Philadelphia: Chelsea House Publishers.

Jennings, Terry. 1989. *Exploring Our World: The Earth*. London: Oxford University Press

Silver, Donald M. 1989. *Earth: The Everchanging Planet*. New York: Random House.

Challond, Helen J. 1982. *Activities in Earth Science*. Chicago: Children's Press.

O'Donaghue, Michael. 1994. *Rocks and Minerals of the World*. San Diego: Thunder Bay Press.

Parker, Steve. 1993. *Rocks and Minerals*. New York: Dorling, Kindersley.

Web Resources

American Museum of Natural History
Rose Center for Earth and Space
Information on earth science, rocks, and minerals.
www.amnh.org/rose/hope/

About - Geology Topics
Many links to information and pictures about earth science, rocks, and minerals.
http://geology.about.com/

USA Today
Weather and climate information for teachers and earth science lessons.
http://usatoday.com/weather/wteach.htm

Rocks for Kids
www.rocksforkids.com

Science Teacher Stuff
Resources for K – 12 Teachers
www.scienceteacherstuff.com/kidstuffearth.html

University of North Dakota
Volcano Info
Legends section
http://volcano.und.nodak.edu/vwdocs/kids/legends.html

Fourth and Fifth Grade Virtual Library
Earth Science Links
http://geocities.com/EnchangedForest/Tower/1217/earthsci.html#b

Mrs. Mitchell's Virtual School
Earth Science Links
www.kathimitchell.com/earthsci.htm