Our Land Rocks!

Bicentennial Nature Center Network

Middle Elementary Curriculum; 2-3 hour program
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Recommended Grades: Middle Elementary (2nd-3rd); can be adapted to other grade levels

Indiana Standards Covered:

***2nd Grade*:**

- ***2.1.1*** **-** Observe, describe, and measure ways in which the properties of a sample of water change or stay the same as it is heated, cooled and transformed into different states.
- ***2.1.6*** **-** Observe, demonstrate, and compare how applied force (push or pull) changes the motion of objects.
- ***2.1.7*** **-** Investigate the motion of objects when they are acted upon by forces at a distance such as gravity and magnetism.
- ***2.2.2*** **-** Experience and describe wind (moving air) as motion of the air that surrounds us and takes up space.
- ***2.3.5*** - On a map, identify physical features of the local community. Example: Use maps and atlases to identify local bodies of water, crops and green spaces.
- ***2.3.8*** - Identify ways that recreational opportunities influence human activity in the community. Example: Identify parks, lakes, swimming pools, rivers and mountains that are used for recreational purposes.
- ***2.4.2*** - Identify productive resources used to produce goods and services in the community. Productive resources include human resources, natural resources, and capital resources used to produce goods and services.

***3rd Grade*:**

- ***3.2.1*** - Examine the physical properties of rock samples and sort them into categories based on size using simple tools such as sieves.

- ***3.2.2*** - Observe the detailed characteristics of rocks and minerals. Identify rocks as being composed of different combinations of minerals.
- ***3.2.3*** - Classify and identify minerals by their physical properties of hardness, color, luster and streak.
- ***3.2.6*** **-** Describe how the properties of earth materials make them useful to humans in different ways. Describe ways that humans have altered these resources to meet their needs for survival.
- ***3.3.9*** - Describe how climate and the physical characteristics of a region affect the vegetation and animal life living there. Example: Growing seasons, types of crops grown, and animal hibernation and migration.
- ***3.3.13*** - Identify and describe how human systems and physical systems have impacted the local environment. Example: List examples of changes in land use in the local community.

Purpose:

To inspire students to begin thinking of Earth not just as a planet with land and water, but as a place made up of rocks and minerals. To introduce students to the concept of land conservation using the Children of Indiana Nature Park as a tool.

Overview:

Students will learn about the basic make up of Earth (crust, mantle, and core), the difference between minerals and rocks, the forces that shape our land (weathering and erosion) and how it all relates to land conservation.

Outcomes:

Students will:

1. Name the different layers of Earth.
2. Explain the difference between rocks and minerals.
3. Name examples of minerals that we have around the house.
4. Describe 3 different properties that a person can use in order to identify a mineral.
5. Define igneous, sedimentary and metamorphic.
6. Interpret the importance of rocks and minerals in relation to the land.
7. Compare weathering and erosion.
8. Become better stewards of the land and the environment as a whole.

Vocabulary Words:

- ***Crust:*** the outermost layer of Earth.
- ***Mantle:*** middle layer of Earth made of mostly solid rock.

- ***Outer core:*** liquid, iron-nickel layer of Earth between the solid inner core and lower mantle.
- ***Inner core:*** extends another 900 miles (1448km) toward the center of Earth, below the outer core, and is believed that it is a solid ball of mostly iron and nickel.
- ***Rock:*** made up of minerals, and does not always contain the same proportions of each of its minerals. Mineral crystals may vary.
- ***Mineral:*** inorganic solid substances that occur naturally in Earth. They have the same chemical make-up wherever they are found.
- ***Igneous:*** formed when magma cools and hardens.
- ***Sedimentary:*** layered rocks that have been under extreme pressure for a very long time.
- ***Metamorphic:*** formed when igneous and sedimentary rocks are subjected to intense heat and pressure deep within Earth; their mineral composition and grain size change.
- ***Weathering:*** causes rocks to fragment, crack, crumble, or break down chemically.
- ***Erosion:*** loosens and carries away the rock debris caused by weathering.

Materials Needed:

Introduction:

- Globe (can be inflatable)
- Earth's layers model (https://www.learningresources.com/product/cross-section+earth+model.do?from=Search&cx=0&query=cross%20section%20earth%20model)
  (A hard-boiled egg could also be used for this activity.)

The Earth, Inside and Out:

- Pre-made slips of paper (you will need to adjust these to the size of your group)
  - 1 Inner Core
  - 4 Outer Core
  - 6 Mantle
  - 12 Crust
- Box or hat

Rock vs. Mineral:

- Baby powder
- Lipstick
- Pencil
- Watch
- Toothpaste
- Chalk

6 Minerals:

- 6 tables
- 6 mineral keys
- 6 pencils
- 6 charts (appendix)
- 6 streak plates
- Samples of quartz, graphite, halite, hematite, galena, fluorite & pyrite
- 6 pennies
- 6 steel files

3 Rock Types:

- Cup (1 for every 3 students)
- Magic Shell (pass this around; may need a few bottles)
- Ice (in each cup)
- Water (in each cup)
- Baggies (1 for every 3 students)
- Bread (cut bread in half, thirds or quarters in advance of program to save resources)
- Jelly (little per group)
- Cream cheese
- M&M's (a few per group)
- 2 pieces of taffy (1 per every 3 students)

A Sour Trick:

- Lemon juice
- Vinegar
- Medicine droppers
- Two pieces of the following: limestone, calcite, chalk and quartz

Shake It Up:

- 15 rough, jagged stones that are all about the same size
- 3 containers with lids (preferably not glass, coffee cans work great)
- 3 clear cups/jars (NO GLASS JARS)
- Permanent marker
- Masking tape

The Program

Welcome/Introduction (10 minutes):

*****Interpretation Note: Many parts of this document are written as speech and will appear in a grey box. Please feel free to adapt and change as necessary. It may be helpful to write out exactly what you want to say (at least in the introduction), but this document is really an outline, not a script.**

Normal introduction for your facility (Thank everyone for visiting, welcome them to the facility, introduce leaders, location of restrooms, etc.).

Do you know why you are here today? Did you know that YOU have been chosen to receive a special gift? Let me ask you something. What do you think of when you hear the word "park"? Slides? Swings? Playgrounds? Well, we have a NEW way to think about a park. When you hear that word, we want you to think of trees, birds, insects, and presents. Wait, presents?! Yes, presents. The State of Indiana has decided to give you a gift, but it's not one that you unwrap, it's one that you protect, just like a special birthday gift. Indiana created The Children of Indiana Nature Park in Centerville, Indiana in honor of you. It doesn't have swings or slides; instead, it has trees, trails, tracks, and turtles. Indiana thinks you are so important, that each one of you can claim a "deed" for a piece of this land. What's a deed? It means that you are in charge of protecting something special. Your teacher is going to help you claim your deed, and you can learn about your piece of land and all of the ways it is growing and changing by visiting a special website listed on your deed. But how can we protect this land or the land that we live on without learning why it is important? Well, we are going to start today! Today's program is called "Our Land Rocks". Once you leave today, you will know why!

Where do we live? (City), Indiana! Sure, but where else could you say that we live? United States and North America! Where else could you say that we live? (Hold up the globe) Earth! And what would you call Earth. Is it a moon? Is it a sun? Is it a star? NO! Well then, what is it? A PLANET!

Just for fun, does anyone know where we live on this globe? (Have a student come up and point.) What is a continent? What is all of that blue stuff all over Earth? Water! What about those tiny blue lines running across the continents? Rivers!

Have any of you ever thought about what makes up OUR planet? Who can name some of these things? We just named a few! (Water, plants, trees, soil, rocks, people, animals, etc.) Today, we are going to dig deeper into Earth.

How many layers make up Earth? Earth is made up of 4 main layers: the crust, the mantle, the outer core and the inner core. (Hold up Earth model.) Can anyone guess which part is which?

**Crust: thought to be no more than 22 miles thick—at its thickest!*
**Mantle: composed of several zones: lithosphere (more rigid than other parts of the mantle), asthenosphere (where very slow movement occurs), and deep mantle (where the rocks are HOT!).*
**Outer core: is molten and is responsible for Earth's magnetic field.*
**Inner core: is solid.*

Today we are not only going to discuss the makeup of Earth, but we will talk about rocks versus minerals, how to identify a few of those minerals and why studying these things are important not only to us, but to the land. Remember, you have been gifted a piece of land in Indiana, so now it's your job to understand how it works so that you can protect it!

The Earth…Inside and Out[1] (20 minutes):

Once again, what are the main layers of Earth? Crust, mantle, outer core and the inner core! For a little fun, we are now going to become a "HUMAN EARTH"!

Have each student choose a slip from your box/hat.

Inner core: Call on the student that has "inner core." Tell them that they need to practice being the inner core by flexing their muscles (or pretend to lift weights)! Once they have practiced for a minute, place them in the middle of your playing area. Tell students that this represents the fact that the inner core is very dense and is solid metal.

Outer core: Have the outer core students form a circle around the inner core. They should face in, towards the inner core. Then, have them walk counterclockwise around the inner core while holding their arms out to the sides and waving them up and down. Tell the students that this represents the fact that the outer core is liquid and is moving.

[1] *Taken from: Ranger Rick's Nature Scope: Geology: The Active Earth; National Wildlife Federation; 1988; pg. 9*

Mantle: Mantle students should be called up next. Have them join hands to form a circle around the outer core. Then have them chant, "Hot rock, hot rock, hot rock" and slowly sway their bodies back and forth to represent the very slow movement that occurs in this layer. *NOTE*: The mantle is made up of different layers. Most of the mantle is made up of solid rock, however, the zone right above the outer core has a place that is hot and considered a weak zone. This part is solid but can "flow" at a very, very slow rate.

Crust: Finally, the last students represent the crust. They will form a circle around the entire rest of the earth. Have them face outward and slowly walk around the rest of the earth while chanting, "moving plates, moving plates." NOTE: In this activity, this technically represents the upper most part of the mantle AND the crust.

Once everyone is set, have them all do their motions and say their chants! Tell the students how great they did and review the parts and characteristics one last time. Ask the students a few questions related to this activity in an effort to remind them of their connection to the planet. For example, you might ask, "What layer do humans impact every day?" "How do we impact it in good and bad ways?" This is a good time to talk about mining.

Rock vs. Mineral[2] (45 minutes):

***Make sure this activity is in a different area so that the students are moving often throughout the program. This activity can be done with all samples at each table or by rotation (as it is written).

Has everyone heard the term "rock" or "mineral" before? Probably all of us have; however, we may not truly know the difference (even adults in your life may not know!). Let's first talk about a few items that we may have around the house that are actually made of minerals.

Baby powder: talc
Lipstick: calcium carbonate, talc
Pencil: graphite, clay
Watch: quartz, hematite, chromite, pentlandite
Toothpaste: flourite
Chalk: limestone

What is a mineral?
1. A mineral is naturally occurring.

[2] *Taken from: Ranger Rick's Nature Scope: Geology: The Active Earth; National Wildlife Federation; 1988; pg. 23*

(To be considered a mineral, it must have been formed by natural geologic processes. Laboratory created gems don't count.)
2. A mineral is a solid.
(By definition, minerals are solid within the normal temperature ranges of Earth's surface.)
3. A mineral is mostly inorganic.
(Generally, a mineral is a naturally occurring solid with a crystalline structure. However, there are a few exceptions such as halite (table salt), and coal which comes from plants (organic) and is generally considered a mineral.)
4. A mineral has a fixed chemical formula.
(Each mineral has a particular chemical make-up no matter where they are found. For example, quartz always consists of one part silicon (an element) to two parts oxygen (another element).)
5. A mineral has an orderly crystalline structure.
(This means that the atoms or ions that make up a mineral are arranged in an orderly and repetitive manner.)

Minerals have certain properties: color, hardness, streak and luster are a few of their characteristics.

We are going to do 6 fun experiments that will help us learn about different ways to identify minerals as well as their characteristics! These are some of the properties that geologists use to identify minerals.

Divide class in to 6 groups. Have one group go to each station. At each station, there should be a mineral key, a pencil, a chart (that they take with them), a streak plate, a sample of one of the minerals, a penny, and a steel file. Once all of the students are where they are supposed to be, begin this activity by giving them directions.

Hold up a piece of fluorite (but don't tell them what mineral it is!). Have the students write the color of quartz in the first row of the "color" column on their charts. (Color is typically purple, green or yellow. But, it can also be colorless, blue, red or black).

Now let's do the streak test! Scratch it on the streak plate or piece of unglazed porcelain (white). Point out that many minerals leave a streak that's a different color from the mineral itself. Also mention that it is sometimes hard to distinguish the streak of very hard minerals.

Next, let's describe its luster—the way a mineral reflects light. Slowly move the fluorite around so that it catches the light (glassy). Minerals that reflect very little light have what we call a "dull luster." And others have what we call "metallic luster." These shine brightly just like a piece of silver or gold. (Note that sometimes the luster can vary for certain minerals. Graphite and hematite can be dull or metallic, depending on the sample.)

Finally, we will test for hardness:

If you can scratch the mineral with your fingernail, it is considered to be very soft.

If you can scratch it with a penny, but not your fingernail, it is considered soft.

If you can scratch it with a steel file, but not a penny, it's medium.

If the steel file doesn't scratch it, then it is considered hard. (Note that results will vary, depending on the quality of the mineral samples they are using and how each person interprets the results.)

For reference, fluorite should be around a medium hardness.

It is now the children's turn! Make sure everyone in the group gets a chance to do something such as keeping track of the results or doing the actual test. Once everyone is done, go over the results with them. Have each group tell everyone about their mineral and what they believe the mineral is that they are testing. Let each group know if they are correct. If they are incorrect, help them decide on a better choice (give clues and have them look at the mineral key).

We now know what a mineral is and how to test its properties. But, what is a ROCK? (Hold up a rock.) What do you all think a rock is? (Possible answers: something hard, gray, sand, heavy etc.) Not all rocks are hard and rigid! There is a rock called itacolumite found in Indiana, North Carolina and Georgia that is actually bendable! (If you can find a piece of this rock, use it to show them how it bends!)

Do you think that all rocks are heavy? Well, check out this rock! (Have a piece of pumice and clear container of water to demonstrate that it floats.) Pumice is a rock, and it FLOATS! So guys, WHAT IS A ROCK?

Geologists define rocks as substances that are made up of one or more minerals. Rocks are the building blocks of Earth. They make up the crust, mantle and the core. Unlike minerals, rocks are not the same through and through. For example, there may be a different proportion of minerals for different samples of granite. Plus, the size of the mineral crystals may vary, which can then make the same kind of rocks look different and have different physical properties.

What type of rock do you think is under your special piece of land at the Children of Indiana Nature Park? Have you ever heard of limestone? Lots of buildings are made of limestone (Lincoln Memorial, Pentagon, and Empire State Building are all made of limestone), and Indiana is a great place to find it! Your land sits on limestone and shale. Since so many things are made of limestone, do you think it's important to pay attention to it? We need to know how to

protect this precious resource, right? Remember, we said that in order to protect it, we need to UNDERSTAND it, so let's keep learning!

There are 3 different types of rocks: igneous, sedimentary and metamorphic. We are going to do a fun activity with food to demonstrate this (The children get to eat the "rocks" if there are not too many in a classroom.). Place students in groups of 3. Each student will get to try one rock.

Igneous: *Explain that when a rock gets really hot, it melts. It turns to a liquid called magma which is found deep inside Earth. When it cools, it forms an igneous rock. (Give each child a cup of ice water. Squirt a little Magic Shell into each cup. Wait while the chocolate hardens. Students can now eat their "chocolate rock.")*

Sedimentary: *Talk about sizes of rocks. Some are very small but can be compressed into a new layer of rock. Tell the students this can sometimes look like a sandwich of rock. (Make a cream cheese and jelly sandwich. You may add other things such as M&Ms or marshmallows to represent a layer of gravel. After adding the top layer of bread, put it into a baggie and have students press down on them as hard as possible.) Emphasize to students that mere layers are not enough to make a sedimentary rock. Those layers must be under extreme pressure for a long time. (This activity, while not inexpensive, can be a very effective reminder of sedimentary rock formations since they likely make or watch others make sandwiches at home often. It is a great way for the student to have something to talk about with the adults at home.)*

Metamorphic: *Ask students if they have ever helped an adult make cookies. What happened after they baked them? Did they change? Some rocks are like cookies. When an igneous or sedimentary rock is under extreme heat and pressure, they change just like cookies. (Hand out 2 or 3 different colored pieces of taffy, Playdough, or sculpting clay to each group. Have students press the substance in their hands.) Tell students that the heat and pressure of their hands is changing these 3 pieces into one big piece like a metamorphic rock!*

Source: http://www.uen.org/Lessonplan/preview?LPid=5712

Review minerals vs. rocks with students! Remind them that rocks are a natural resource and important to our state. Remind them of the limestone discussion and thank them for being good scientists.

Minerals, Rocks and Our Land Hike (60 minutes):

Things to be discussed on your hike:

1. **Why do we need to know about rocks and minerals?** Ask students to give some reasons we need to know about rocks and minerals. Make sure to relate rocks and minerals back to the land, how we use the land, what happens when we "use up" all of our resources, etc. Also, ask students if they know why it is important to study the history of rocks.

Background information for leader: We use rocks for art, architecture, cement, ceramics, currency, defense, energy for lighting/heating/cooking/moving (uranium, coal, gas, petroleum), farming (tools and fertilizers), fire (flint and pyrites), hunting (spears and bolas), jewelry, making strong metals, making monuments, music (metal strings for some stringed instruments), painting (pigments), road surfaces, sport (curling), and weapons. All living things depend on nutrients from soil (weathered rock).

Also, studying the rock record gives us insight into past environmental changes, from which we may be able to make predictions about how Earth could change in the future.

2. **Shaping of the landscape:** While hiking on your property, try and find places that really show weathering and erosion at work for this discussion. Look for signs of erosion caused by water on bare hillsides and slopes. You can also look on the banks of rivers or streams. Search for places on your property where trees are growing out of rocks, even if it is just a plant growing through a crack in the sidewalk or patio. Lastly, look for smooth rocks in stream beds and loose rocks and soil at the bases of any slopes.

Go off trails and search for lichens on rocks. (You can explain to them the lichens can start to grow in rock crevices, and as they grow they produce a mild acid which can aid in the breaking down of rocks.)

There are two experiments to do with the students on the trail. This is to be done together as a group, but allow different students to assist with the processes.

a. A Sour Trick: (Items should be put out before program begins.)

1. Put a few drops of lemon juice on the four rock samples.
2. Put a few drops of vinegar on each of the four other rock samples.
3. Look and listen carefully each time we add the vinegar or lemon juice.

What happened when we put lemon juice on each rock? What happened when we put vinegar on each rock? Did the lemon juice and vinegar act the same way on each rock? Why did some of the rocks react differently? What do you think this experiment has to do with weathering? This is a good opportunity to talk about "acid rain" caused by pollution.

Background: The vinegar and lemon juice both contain weak acids. These mild acids can dissolve rocks that have a certain mineral in them: calcium carbonate. The lemon juice and vinegar should have bubbled or fizzed on the limestone, calcite and chalk—all containing calcium carbonate. There should not have been any reaction with the quartz. Water often contains weak acids that dissolve rocks containing calcium carbonate and other minerals.

b. Shake it up[3]: The day before your program, separate the stones into 3 piles of 5, and put each pile on a sheet of paper. Label each pile "A", "B" and "C." Then label the jars "A", "B" and "C." Fill each jar halfway with water and add the stones from the matching pile for each jar. Let the stones stand in the water overnight. Take those jars to the spot on the trail you will be discussing/doing this experiment.

1. Have students shake jar "A" hard 100 times.
2. Remove the stones from jar "A." Observe the stones and the water.
3. Shake jar "B" about 1000 times (make sure students all get a chance to help with this one—maybe event teachers and adults!).
4. Remove the stones from jar "B." Observe the stones and the water.
5. Do NOT shake jar "C." Just remove the stones and observe them.
6. Lastly, observe the 3 piles of stones and the 3 jars of water.

Ask the students questions like, "How do the piles of stones differ? Does anyone know why they are different? How do the jars of water differ? How does this show what happens to stones that get knocked around in a fast-moving river or stream?"

Background: The stones that were shaken up should have more rounded edges than the stones that weren't shaken. And the stones in jar "B" should have rounder edges than the ones in jar "A." Both jars should have some sediment in the bottom, but jar "B" should have more since more shakes would have broken off more bits of rock. The same thing happens to rocks that are carried along in rivers or are churned about by the surf.

Our land is constantly changing due to weathering, erosion and sometimes even due to humans.

[3] *Activity taken from: Ranger Rick's Nature Scope: Geology: The Active Earth; National Wildlife Federation; 1988; pg. 38-39.*

How do humans change the land? How do they change rocks/formations? (Discuss the good and bad: drilling, mining, etc.) There are two forces that are constantly at work wearing away rocks that make up the Earth's crust. Does anyone know what one of those forces is called? Weathering! (Try and find spots on your property, while hiking, where these different types of weathering are or have occurred.)

*1. **Freeze and Crack Cycle:** How many of you have sidewalks leading up to your front door or have a paved driveway? Have you ever noticed how quickly the cracks on your sidewalks and drives grow? Does anyone know what is happening? Water, whether from rain or snow, seeps into cracks and freezes, which then forces our sidewalks and drives to form cracks or widen ones that are already there. When water freezes, it increases in size by about 9%. If this happens over and over again, solid rocks (and concrete/blacktop) will eventually be reduced to rubble.*

*2. **Roots of Destruction:** Have you ever noticed plants/trees growing in the cracks of rocks that were formed through ice? You may have noticed this in your neighborhood sidewalk or even while driving down the road. Soil can get collected in the cracks of these rocks which then can be a perfect place for a plant to grow. As a plant's roots grow, they expand and apply pressure to the rock, forcing the crack to widen and deepen. Eventually the roots can split rocks apart—even large boulders!*

*3. **Chemical Breakdowns:** Some minerals are changed into different minerals as they react with chemicals in our air and water.*

There is a very positive thing about weathering. Can anyone guess what it is? Think about what is happening to these rocks. They are getting broken down into smaller and smaller pieces. What will this eventually turn in to? (Silt and sand!) Both silt and sand are two important types of soil! Decomposed plant and animal material are also ingredients of soil. Could we survive without soil? (NO!) Why not? (Plants and trees need them.) Those plants and trees give us oxygen. What else do plants and trees give us? (FOOD!) Plus, they feed our food, too! Think cows, pigs and chickens!

Quick interpretation note: **What's the difference between weathering and erosion?**

Weathering involves two processes that often work in concert to decompose rocks. Both processes occur in place. No movement is involved in weathering. **Chemical weathering** involves a chemical change in at least some of the minerals within a rock. **Mechanical weathering** involves physically breaking rocks into fragments without changing the chemical make-up of the minerals within it. It's important to keep in mind that weathering is a surface or near-surface process. As you know, metamorphism also produces chemical changes in rocks, but metamorphic chemical changes occur at depths where either

the temperature and/or pressure are significantly higher than conditions found on Earth's surface.

As soon as a rock particle (loosened by one of the two weathering processes) moves, we call it **erosion** or mass wasting. Mass wasting is simply movement down slope due to gravity. Rock falls, slumps, and debris flows are all examples of mass wasting. We call it erosion if the rock particle is moved by some flowing agent such as air, water or ice.

So, here it is: if a particle is loosened, chemically or mechanically, but stays put, call it weathering. Once the particle starts moving, call it erosion.

Taken from: http://geomaps.wr.usgs.gov/parks/misc/gweaero.html

Closing:

Once you get back from the hike, do the review!

What are the layers of Earth? (Crust, mantle, outer core, and inner core.) What is a mineral? (They are inorganic, solid substances that occur naturally in Earth. They have the same chemical make-up wherever they are found.) What are rocks? (They are made up of minerals. They do not always contain the same proportions of each of its minerals, and the mineral crystals may vary.) What are some ways our land changes? (Weathering, erosion, and people!) How do people change it? Do you remember what is under your piece of land? Limestone and shale! If we dig up all of the rock and use it (because remember, it has SO many cool uses), what happens to the land on TOP of it? Can we grow food there? No! Can we grow a forest? No! YOUR piece of land (the Children's Park) has been protected in your honor, and guess what? No one is allowed to dig up your rocks! Let's all remember to think about rocks and minerals as a super important part of our land and learn to use these resources wisely!

Thank you for visiting!

Group Member Names:_____

#	Color	Streak	Luster	Hardness	Name
1					
2					
3					
4					
5					
6					
7					

Mineral Key

Color	Streak	Luster	Hardness	Name
Gray	**Dark Gray**	**Metallic**	**Soft to Medium**	**Galena**
Colorless (may have tints of color)	**White**	**Glassy**	**Soft**	**Halite**
Colorless white (may have tints of color)	**White**	**Glassy**	**Hard**	**Quartz**
Brassy yellow, gold	**Blackish**	**Metallic**	**Hard**	**Pyrite**
Gray	**Gray, Black**	**Dull, Metallic**	**Very Soft**	**Graphite**
Red, Brown, Gray, Black	**Dark Red, Reddish-brown**	**Dull, Metallic**	**Hard**	**Hematite**
typically purple, green and yellow. Also colorless, blue, red and black	**white**	**Vitreous (like glass) to Dull**	**Medium**	**Fluorite**

Taken and adapted from: Ranger Rick's Nature Scope: Geology: The Active Earth; National Wildlife Federation; 1988.

Resources:

http://billybproductions.com/wp-content/uploads/2010/12/BB-Geology-Rocks.docx.pdf

Ranger Rick's Nature Scope: Geology: The Active Earth; National Wildlife Federation; 1988.

http://www.kidsgeo.com/geology-for-kids/

http://www.museum.state.il.us/ismdepts/geology/activities.html

http://www.science-fest.org/Rock%20On!%20--%20Final%20Edition%20-%20Debbie%20Cubillos.pdf

http://www.earthsciweek.org/classroom-activities

http://www.discoveryeducation.com/search/page/-/-/lesson-plan/earth%20science/index.cfm

http://www.uen.org/Lessonplan/LPview.cgi?core=1217