Rocks and Minerals

SUBJECT: Science
GRADES: 6th (*TEKS met*); age appropriate 4th-8th grades
DURATION: Approximately 45 minutes
ACTIVITY SUMMARY: Students will observe rock and mineral samples to learn about the basic properties of minerals and the three different types of rocks.

OBJECTIVES:
Students will be able to:

1. Determine the difference between a rock and a mineral based on physical properties.
2. Classify rocks as metamorphic, igneous, or sedimentary

MATERIALS:

- Mineral samples (amethyst, calcite, pyrite, peacock ore)
- Rock samples (pumice, granite, obsidian, limestone, sandstone, marble, schist, quartzite)
- Mineral and rock sort sheets, hand lens, penny, glass plate, porcelain tile, pencil, Rocks and Minerals handout

BACKGROUND:

Geology is the study of the Earth and the materials it is made of. Geology looks at the structure of these materials and the forces acting upon them as well as the organisms that have inhabited the planet. Geologists are the scientists who study how the- se materials, processes and organisms change over time.

Two of the substances that geologists study are rocks and minerals. A mineral is composed of the same substance throughout. There are about 3000 known minerals on the Earth. Rocks are made up of two or more minerals. Think of a rock like a chocolate chip cookie. The cookie is made of sugar, butter, flour and chocolate. The cookie is like a rock and the sugar, butter, flour and chocolate are like minerals. You need minerals to make rocks, but do not need rocks to make minerals.

Minerals have many different properties, some of which are very useful in identification. Luster describes the way light interacts with the surface of a mineral. A metallic luster is reflective and opaque—like metal. A vitreous luster accounts for about 70% of all minerals. Minerals with a vitreous luster have reflective properties similar to glass.

Minerals with an adamantine luster display extraordinary brilliance and shine. Minerals with a greasy luster appear as if they are covered in grease. A mineral with a waxy luster looks as if it's coated with a layer of wax. *Note: every mineral has a characteristic luster but there is no scientific method to determine luster. Therefore it may appear as one luster to one person but a different luster to another. It is usually noted as a mineral property but not used to help with identification.*

The color of a mineral serves to narrow down the number of possible choices since it is the most obvious property noticed. However, most minerals may exhibit a variety of colors, so color is not a reliable diagnostic property.

Hardness plays a major role in identifying a mineral. Hardness is defined by how well a substance will resist scratching by another substance. If mineral A scratches mineral B, but mineral B does not scratch mineral A, then mineral A is harder than mineral B. In 1822, an Austrian mineralogist Friedrich Mohs created a scale for measuring hardness. It is still the standard for measuring hardness today. The scale consists of numbers 1-10; 1 being the softest and 10 being the hardest. Each number represents a different mineral—each harder than the previous. The 10 minerals are:

1.	Talc	6.	Feldspar
2.	Gypsum	7.	Quartz
3.	Calcite	8.	Topaz
4.	Fluorite	9.	Corundum
5.	Apatite	10.	Diamond

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26495 Natural Bridge Caverns Rd
San Antonio, TX 78266
210-651-6101
www.naturalbridgecaverns.com

All minerals can be classified in this scale since talc is the softest known mineral and diamond is the hardest. The following is an example to demonstrate how to use the scale: Suppose a mineral scratches fluorite but not apatite, then it has a hardness between 4 & 5.

Several common household items have a fixed hardness and can be used to test for hardness: Fingernail-2.5, Copper penny-3.0, Nail-4.0, Glass-5.5, Porcelain tile-6.5.

Streak is the color of a crushed mineral's powder. The color of the powder may differ from the actual color of the mineral. It is very useful for mineral identification. Many minerals come in different colors, but their streak color will always be the same. For example, calcite can be white, grey, green, yellow, etc., but its streak is always white. The streak test is most useful for identifying dark colored minerals, especially metals. A simple way to test streak is to swipe the mineral across a streak plate—an unglazed piece of porcelain. The color of the streak plate is white so the color of the mineral trace is easy to see. Streak plates have a hardness of about 6.5 on the Mohs scale, so the test cannot be used on minerals harder than 6.5.

There are three general types of rocks. They are sedimentary, metamorphic, and igneous. Igneous rocks are formed when magma cools and hardens. Some cool slowly, deep within the Earth's surface (intrusive igneous rocks) while others cool much more quickly near or above the Earth's surface (extrusive igneous rocks). Because intrusive igneous rocks cool slowly, there is time for large crystals to form. Granite is an example of this type of rock. Extrusive rocks cool so quickly that there is not much time for crystals to form and as a result, the crystals are much smaller. Basalt is an example of this type of rock. Obsidian is an igneous rock that cooled so fast that no crystals had time to form. As a result, it looks like shiny, black glass. Igneous rocks do not usually have fossils or any sort of banding (foliation). They are made of two or more minerals and the crystals are usually different sizes. Sometimes they will have openings formed by bubbles of gas that were trapped during the cooling process. Pumice is an example of this type of rock.

Metamorphic rocks are formed when a rock is changed due to extreme heat and pressure. The pressure comes from rock layer piled on top of rock layer. The chemicals in the rock are rearranged resulting in a completely new rock from the original one. Limestone for example, when under heat and pressure for thousands of years will change into marble. Sometimes the pressure will push the crystals and minerals into an arrangement that looks like banding—called foliation. They may have alternating bands of light and dark (from the new orientations of the minerals) and visible layers of crystals. Metamorphic rocks rarely have fossils. Metamorphic rocks do not usually have pores or openings.

Sedimentary rocks are formed when pieces of sand, dirt, and other types of sediment are cemented together in layers. Rocks on the surface of the Earth are continually broken down into smaller pieces by wind, water, plant roots, etc. These pieces can be eroded away by wind and water and often deposited at the bottom of a body of water in layers. The layers build on top of each other and are compacted. Cementation happens as dissolved minerals become deposited in spaces between the sediments and act like glue to hold the pieces together. In some samples you can see the pieces that have been cemented together (conglomerate and sandstone). Sedimentary rocks often contain fossils of organisms that were buried during the layering process.

PROCEDURE:

Part 1: Rock or Mineral?

1. Discuss with students what the difference is between a rock and a mineral. Minerals are made of just one substance and are the same throughout. Rocks are made of more than one substance—often more than one mineral. (See the Background section for the cookie analogy.)

2. Have students work together in groups of 2-4. Students should observe the samples and try to sort them into two groups—rocks or minerals. Students can use the sort sheet for assistance.

3. Once all groups have finished, go over each sample and discuss why it fits into the appropriate group. Have students record the correct answers in their Rocks & Minerals booklet and then answer the remaining questions in their booklet for part 1.

Part 2: Minerals

1. Discuss with students the 4 properties discussed in the background: color, luster, hardness, and streak. Be sure to show actual examples or pictures when talking about luster.

2. Have students observe each mineral sample. Record the color of each in their Rocks & Minerals booklet.

3. Have students use pictures and descriptions to determine the luster of each mineral sample. Students should record the luster for each mineral in their booklets.

4. Hardness test: Have students attempt to scratch a penny, glass plate, and porcelain tile. Have them record their results in their booklet. Explain to students that if the mineral can scratch the object that means it is harder than the object. Remind students of the relative hardness of each object they scratched-- Copper penny-3.0, Glass-5.5, Porcelain tile-6.5.

5. Have students attempt to scratch each of their mineral samples on each other mineral sample. List the minerals in order of increasing hardness in their booklet.

6. Streak test: Have students rub each of their minerals on the porcelain tile. Students should record the color of the powder in their booklets. If no powder is left, the streak color is clear.

7. Have students answer the remaining questions for part 2 in their booklets.

Part 3: Rocks

1. Explain to the students that there are three basic types of rocks: sedimentary, metamorphic, and igneous. Have students observe their rock samples closely. They should look at grain size, color, crystal size, and if there are bands or layers. They should look for similarities and try to sort them into the three different types. Use the sort sheet for assistance.

2. Once students are finished, discuss the characteristics of each type of rock discussed in the Background section. Let students decide if they want to make any changes to their groupings.

3. Once all groups are finished, go over each sample and discuss why it fits into the correct group. Students should fill in the correct answers in their booklets.

4. Help students to finish identifying each mineral and rock sample. Students should fill in the table in their booklets.

5. Discuss with students how each different type of rock forms. Have students fill in the Rock Cycle diagram in their booklets.

ASSESSMENT:

Students can be assessed through observation during the activity and by their answers in their Rocks & Minerals booklet. An additional rock identification worksheet is included at the end of this lesson for homework or an extension. Students most likely will need access to rock books or the internet to help them with the worksheet.
The activity called “Modeling the Rock Cycle” would be a good follow-up lab.

RESOURCES:

https://www.rocksandminerals4u.com/
https://education.nationalgeographic.org/resource/rock-cycle

Rocks & Minerals

What is geology? _____

Part One: Rock or Mineral?

Sample	Rock or Mineral?	Sample	Rock or Mineral?
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

Write a definition for rock in your own words.

Write a definition for mineral in your own words.

Part 2: Properties of Minerals

Sample #	Color	Luster	Harder than?	Streak Color

List your mineral samples in order from softest to hardest.

Softest _____ _____ _____ _____ Hardest

Why would knowing the properties of a mineral be useful?

What are some uses for minerals?

Part 3: Types of Rocks

Sample #	Type of Rock

Identification

Sample	Name	Sample	Name
1		7	
2		8	
3		9	
4		10	
5		11	
6		12	

ROCK CYCLE

Metamorphic Rock

Sedimentary Rock

Igneous Rock

Use arrows to label the different processes that are involved in the formation of each rock type. Use the options below. (Hint: Each will be used twice.)

- Melting & Cooling
- Heat & Pressure
- Weathering, Erosion & Deposition

What metamorphic rock does each of the following change into?

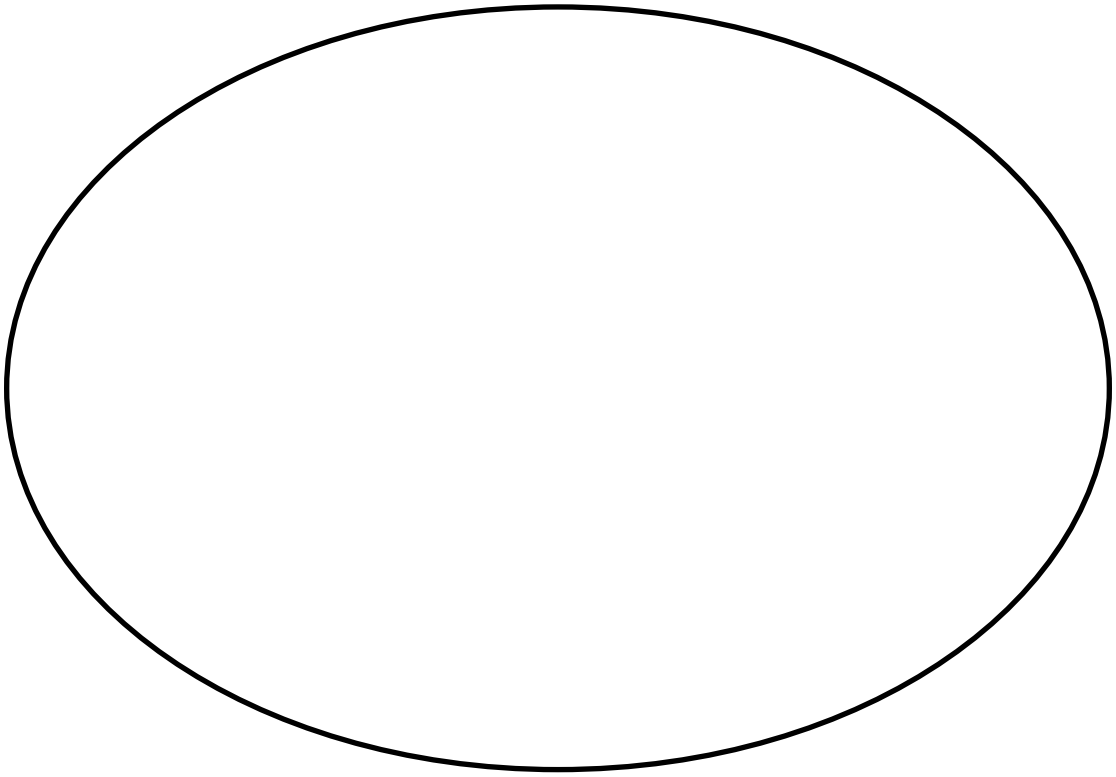
Sandstone _____

Limestone _____

Granite _____

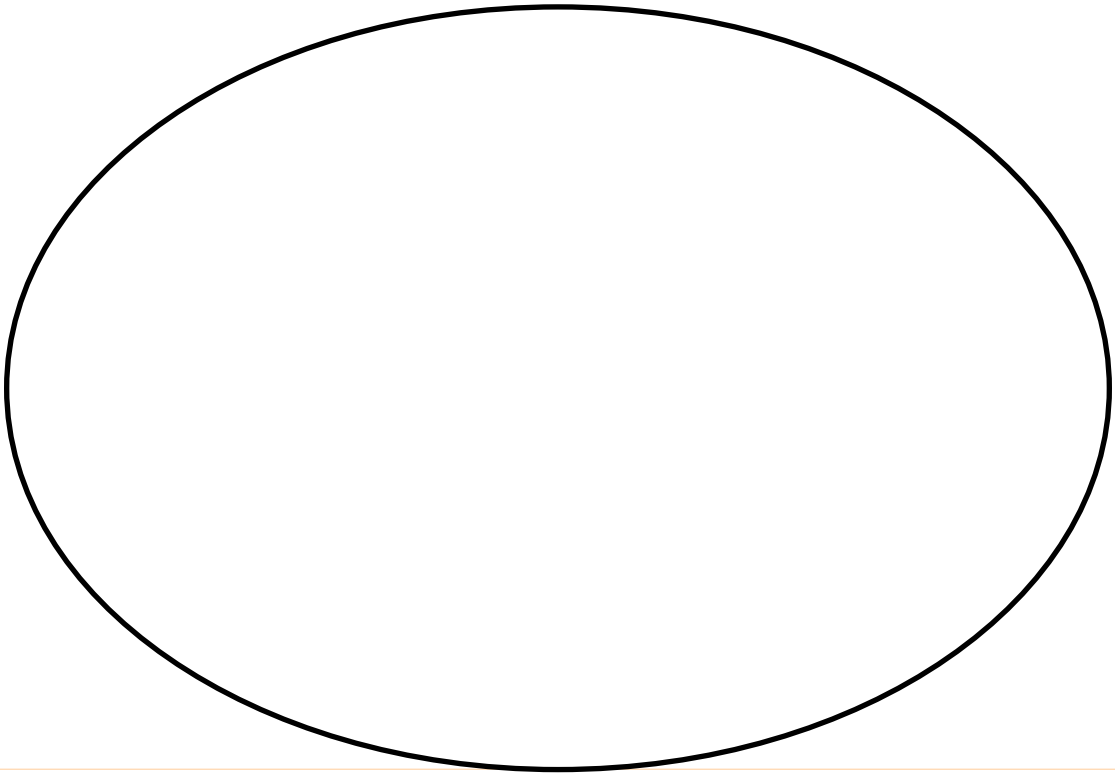
MINERALS

Are the same throughout

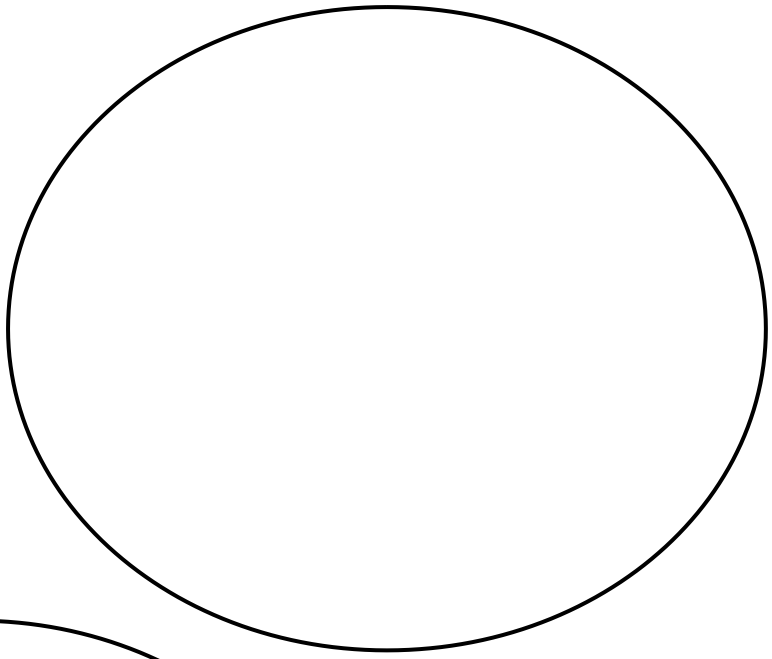


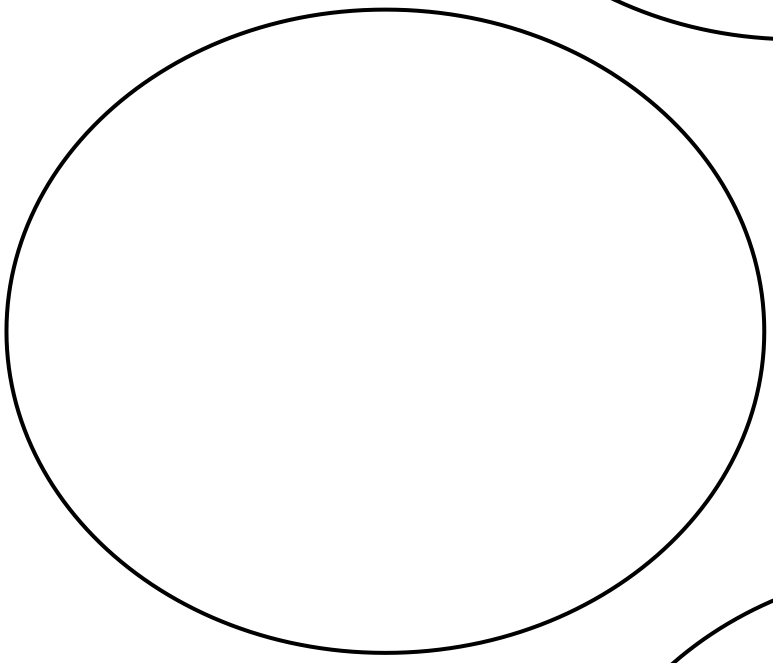
ROCKS

Typically different throughout



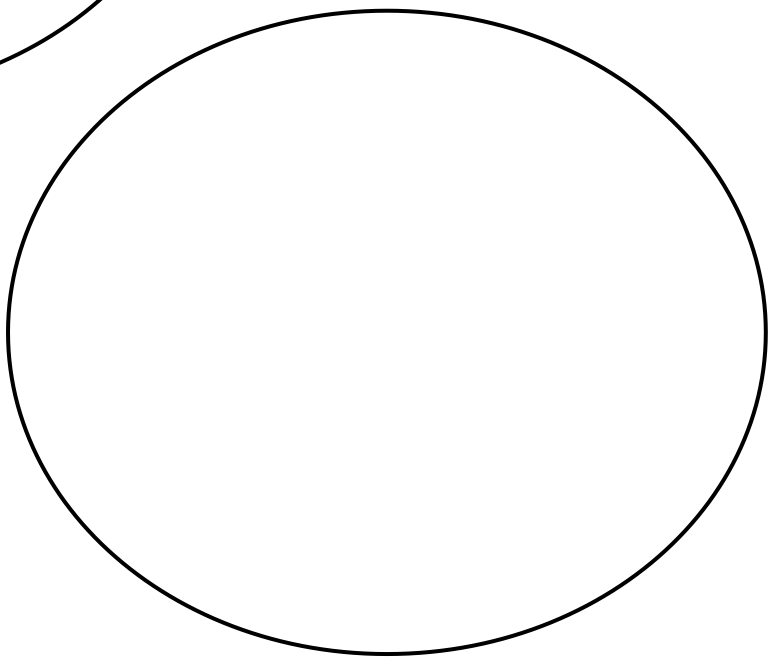
SEDIMENTARY





METAMORPHIC

IGNEOUS



WHO AM I?

1. I am white, grey, or black in color. I have a hardness between 3 and 4. I am composed of the calcium from skeletons or coral and seashells. I slowly dissolve from acid rain. Who am I? _____
2. I am black and glassy and have a hardness of 5.5. I am formed when magma from a volcano cools very fast. Who am I? _____
3. I am black or grey in color. I have a hardness between 5.5 and 6. I make up most of the ocean floor. Who am I? _____
4. I am speckled gray, black, pink, and clear. I have a hardness between 6 and 7. I am one of the hardest building stones. Who am I? _____
5. I can be silver, black, white or even green. I have a hardness between 4 and 5. When transparent, I am used in lamps. Who am I? _____
6. I am red or tan in color. I have a hardness between 4 and 7.5. I am used for paving and in some floors. Who am I? _____
7. I am either gray or white in color. I have a hardness between 4 and 7. I am composed or recrystallized limestone. I am used in the construction of statues and buildings. Who am I? _____
8. I am mostly grey in color. I have a hardness of 1. I am created from large mud deposits. Who am I? _____
9. I am greyish or beige in color. I have a hardness of 5.5. I am composed of glass, dust, and glass. I am formed when magma shoots rapidly out of a volcano and cools quickly. My holes are created by gas bubbles during a volcanic eruption. Who am I? _____
10. I am dark grey and shiny. I have a hardness between 2.5 and 5.5. I am very fine-grained. I am used in roofing shingles and flooring. Who am I? _____

Word Bank: slate, marble, granite, limestone, schist, basalt, shale, pumice, obsidian, sandstone

TEKS ADDRESSED:

Science

6th Grade

1(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations

1(B) use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems

1(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards

1(D) use appropriate tools such as graduated cylinders, metric rulers, periodic tables, balances, scales, thermometers, temperature probes, laboratory ware, timing devices, pH indicators, hot plates, models, microscopes, slides, life science models, petri dishes, dissecting kits, magnets, spring scales or force sensors, tools that model wave behavior, satellite images, hand lenses, and lab notebooks or journals

1(E) collect quantitative data using the International System of Units (SI) and qualitative data as evidence

1(F) construct appropriate tables, graphs, maps, and charts using repeated trials and means to organize data

1(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems

3(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories

3(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats

3(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence

10(C) describe how metamorphic, igneous, and sedimentary rocks form and change through geologic processes in the rock cycle