ROCKS- Introduction

Rocks are made up of minerals. Minerals each have their own color, shape, hardness, way of splitting, and luster. Some rocks are made of only one mineral, such as marble, which is made of calcite. Other rocks are made up of many minerals. Granite is usually composed of quartz, feldspar, and mica. The mineral mica is what gives granite its small specks of sparkle.

All rocks can be categorized into one of three types, igneous, sedimentary, or metamorphic. Igneous means formed by fire or heat, and igneous rocks are formed deep within Earth. They begin as hot, molten (liquid) rock, called magma. When magma reaches the surface of the Earth, it is called lava. Magma that cools on the surface is called extrusive igneous rock. Intrusive igneous rock has cooled inside the earth. Pumice is an extrusive igneous rock. As this kind of rock cools, air bubbles form in it --so many bubbles that pumice actually floats! Lava can be thrown from volcanoes and cool so quickly that it is smooth and glasslike. The rock obsidian is a natural volcanic glass. Granite, obsidian, and basalt are all igneous rocks. Basalt is the most common igneous rock. Basalt is dark, like obsidian, but not glasslike.

Sedimentary rocks are formed from sediments, or layers of materials that have come to rest on the bottom of lakes and seas. Over time larger rocks are weathered into small pieces of sand, gravel or smaller rocks. Pieces of seashells and soil may be included in this sediment. The sand and small rocks settle into layers in water where natural glue-like minerals cement them together into solid rock. Sandstone is a common sedimentary rock. It is not unusual to find fossilized seashells in sandstone. Sandstone is easy to identify. When you rub it on the ground grains of sand come off. Shale is another sedimentary rock, formed from clay. Limestone forms from the shells of long-dead sea creatures. White chalk is made from limestone. Limestone and shale are used in making cement. One of the largest and most beautiful examples of sedimentary rock is the Grand Canyon, which is made up of sandstone, limestone and shale. Metamorphic means “changed” and metamorphic rocks are rocks that have changed from igneous or sedimentary forms. The change occurs as a result of heat and pressure, or both. Slate is a metamorphic rock that was once shale. Over many years, as tons of pressure is applied to it, the shale becomes hot and is changed to slate. Slate is used for roofing tiles and sometimes chalkboards. Limestone changes into marble over time. Sometimes rocks have changed so much that it is impossible to tell what they were originally.

ANSWER THE QUESTIONS ABOUT ROCKS

1) Rocks can be categorized into how many main types?
2) What does igneous mean?
3) In what way are metamorphic rocks “changed”?
4) Why does pumice float?
5) Explain why some lava is like glass.
6) What is magma?
7) What causes the changes in metamorphic rock?
8) What kind of rock is The Grand Canyon made from?
9) What common school item is made from a sedimentary rock?
10) Explain the process of how sedimentary rocks form.
ROCK HARDNESS

Say “rock” and most people will picture a hard object. However, not all rocks are hard. For example, the rock talc, from which talcum or baby powder is made, is so soft you can pinch it into powder between your fingers!

In 1812, Friedrich Mohs, a German mineralogist, devised a hardness scale for rocks and minerals that is still in use today. It is known as Mohs Scale. The scale runs from 1-10, with 1 being the softest. Mohs chose ten minerals and arranged them in a way so that any mineral on the scale would only scratch those below it. Everyday objects can be used to test where a rock is on the scale. A fingernail has a hardness of 2.5, the blade of a pocket knife is 5.5. U.S. pennies have a hardness of 3. Knowing the hardness of everyday objects allows you to test samples without special materials. Rocks with a hardness of 6 and above will scratch glass. Glass has a hardness of 5, and will scratch 5 and below.

Talc, with a hardness of 1, is the softest rock. The hardest rock, a 10, is a diamond. Although the diamond is hard enough to scratch glass, it is a myth that only a real diamond will scratch glass. Even quartz, at 7, will scratch glass. Do not try to test the hardness of rock samples on a window; you may scratch either the window or the rock!

ANSWER THE QUESTIONS ABOUT ROCK HARDNESS

1) Are all rocks hard?

2) What is the scale to measure rock hardness called?

3) Who was Friedrich Mohs?

4) What are the hardest and softest minerals?

5) What does it mean for a fingernail to be a hardness of 2.5?

6) Can you determine if a diamond is real by trying to scratch glass with it?
ROCKS WE USE

As common as rocks are, people often take no notice of them unless they are lying on the ground. Whether or not we notice them, we are surrounded by rocks! Mountains are made of rock, and the Earth’s crust is rock. Soil is made of small pieces of rock.

We use rocks for buildings and roads. Beautiful marble statues are made from rock, as is the diamond in a ring. Baby powder (talc), chalk (limestone), and roof tiles (slate) are made from rocks.

All metal objects, whether they are spoons, cars, jewelry or soda cans are made from materials found in rocks. Aluminum, tin, copper, silver, gold, nickel and bronze all are mined from ore, a natural combination of rock minerals.

Buildings and roads built from rocks thousands of years ago are still standing and in use today. The Roman roads, the Great Wall of China, the Pyramids of Egypt, and Notre Dame Cathedral are examples of this. Sandstone, limestone, granite and marble were used to build these long-lasting structures. Today, many materials used for construction are man-made, with natural stones used for decoration. But we can still see rocks just looking out of the window…because even window glass is made in part with sand and limestone!

The ancient Egyptians carved statues out of a metamorphic rock, quartzite. Quartzite forms from sandstone.

A common use of lava rock is in landscape designs, but lava in the form of pumice is also used as a beauty aid. Small pieces of pumice are used to smooth out rough skin, especially on the feet.

Early people used rocks to provide them with pigments for painting homes and bodies. Many of these crushed rocks were very poisonous. These colors are now produced chemically, in a laboratory. The oldest known rock used for pigment was chalk, for white coloring. Today pure, bright white artist paints contain titanium dioxide, a pigment made from two different minerals.

Coal, originally vegetation that changed with pressure, is used for most of the world’s power. It is burnt in large power plants. While the mining of coal is much safer than in previous times, it is still the most dangerous job available.

Obsidian and flint were chipped into arrowhead shapes for hunting. Both rocks break in any direction, which helps to sharpen an edge.

If you have a pet bird, you know that you feed it rocks in the form of grit or bird gravel, needed for grinding up food.

The pencil you use is made of graphite, not lead, which is pure carbon mixed with clay, another type of rock. You probably even brush your teeth with a kind of rock, fluorite!

**ANSWER THE QUESTIONS ABOUT ROCKS WE USE**

1) Why would you say we are “surrounded” by rocks?

2) What was the first source of white pigment?

3) What does coal form from?

4) Name some ancient monuments or constructions made from rock that still exist.

5) List four things in your classroom that come from rocks.
Answers:

ROCKS- Introduction
1) Igneous, sedimentary and metamorphic
2) Made by fire or heat
3) They used to be either igneous or sedimentary rock
4) It is full of air bubble holes
5) When lava cools quickly there is no time for bubbles to form
6) Melted rock inside the Earth
7) Over time pressure and/or heat changes them
8) Sandstone, limestone and shale
9) Chalk
10) Small pieces of rock, sand, seashells and soil settle on the bottom of lakes or seas and are cemented together with natural mineral glues

ROCK HARDNESS
1) No, some are soft enough to crush with your fingers
2) Mohs’ scale
3) A German mineralogist who designed a scale for measuring rock hardness
4) The hardest is a diamond, the softest is talc
5) A fingernail will scratch a rock or mineral with a hardness under 2.5
6) No, any rock or mineral with a hardness of 6 or more will scratch glass

ROCKS WE USE
1) Our houses and street have rocks in their construction. Metal comes from rocks.
2) Chalk, which is limestone
3) It was originally vegetation
4) Possible answers include the Great Wall of China, Notre Dame, Roman roads, pyramids of Egypt or the students may come up with their own ideas
5) Possible answers include chalk (limestone), chalkboard (slate), metal objects, marble or other rock sculptures and statues, stone in jewelry, glass, or perhaps even rock paper weights!
ROCK ACTIVITIES

Where to Find Rocks

Landscape supply stores, or rock yards, may be willing to provide samples of various rocks for a nominal price, if not for free, especially if you let them know they are for educational use.

SEDIMENTARY

Make Sandstone

Water
Paper cups
Epsom salts
Sand

Put 1 ½ inches of water in a paper cup. Dissolve 2 ½ TBS of Epsom salts in the water. Put 1 ½ inches of sand in the bottom of another cup. Pour the salt mixture into the sand and stir until the sand is wet. Let it sit undisturbed for an hour. Carefully pour the water off the top, trying not to disturb the sand. Repeat several times over the first day. Do not cover. Let sit undisturbed for one week. When dry, peel off the paper cup. If it is still damp, let it sit a while longer. The resulting “rock” demonstrates how sedimentary rock is formed.

Dissolving Rock

White chalk
Vinegar
Small plastic cup

Place the chalk in the cup, and pour vinegar in to halfway up the chalk. Over the next week check the chalk for changes.

What happens?
Chalk is limestone. Vinegar is an acid, which eats away at the rock and breaks it down.

What does this show?
Rain in some parts of the world is becoming naturally acidic due to carbon dioxide (CO2) given off by autos and factories. This acid rain causes erosion of rock to occur more rapidly than usual. Vinegar is much stronger than acid rain, but you can see the results much faster. This is happening not only to rock formations, but to monuments such as the Parthenon in Greece.
Limestone Cave
Small plastic water bottle
Foil
Nail or sharp pencil
Jar or bottle with an opening larger than the bottle
5 cups damp sand
1 cup sugar
1 cup warm water

Cut the bottom off the water bottle and discard. Remove the cap, discard it, and cover the opening with foil. Use the nail or pencil to poke a few small holes in the foil. Place this into the opening of the larger bottle or jar, upright. Put 2” of sand in the water bottle, pressing firmly to remove air pockets. Put 1” of sugar on top of the sand, pressing firmly against side of bottle. The sugar represents limestone under the ground. Put another 2”-3” of sand on top, pressing down firmly. Slowly add ½ cup of warm water. Wait for it to drain out the foil end, and then add another ½ cup. Set aside for 2 or 3 hours. You should see caves formed in the sand. This demonstrates how water dissolved underground limestone deposits, leaving caves.

METAMORPHIC

Metamorphic rock model
Modeling clay of various colors
Waxed paper
Books or other heavy objects

Roll clay into small, pea-sized balls. Place them together between two pieces of waxed paper. Place this on a hard, flat surface and top with several heavy books or other objects. Picture these books pressing down on rocks, producing pressure and heat, changing them over time from igneous or sedimentary rocks into metamorphic. Remove the books, and peel away the waxed paper to see the results.

IGNEOUS

Granite Paper
White drawing paper
Crayons (colors that are in granite, such as grays, black, white, pink)

Place the paper down on a sidewalk and rub with the side of a crayon. Move the paper slightly and re-rub with another color. Repeat with a third color. The resulting paper will resemble granite and can be used for covering books, or to cut rock shapes out of for notebooks or display.

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COMMON ROCKS- REFERENCE

IGNEOUS

Obsidian
A volcanic rock that was formed when lava cooled so quickly there was no time for crystals to form, or for bubbles to appear. Looks like black glass. Obsidian is well known for its history as arrow heads. Obsidian has hardness between 5 and 5.5.

Granite
Composed of mainly quartz, feldspar and mica. Granite formed within the Earth. Some mountain ranges, for instance the Sierra Nevada, in California, are formed almost entirely of granite, shoved upward as the plates in the Earth’s crust shifted. Granite is 7 on the hardness scale, making it a popular choice for kitchen and bathroom counters and shower walls.

Basalt
Most common of the igneous rocks, basalt formed on the surface of the Earth. Like obsidian it formed from hardened lava, but it is fine grained and not glassy. Basalt may form huge many-sided columns as seen in the Giant’s Causeway in Ireland. Basalt has a hardness of between 3.5 and 4.

Pumice
Lava that is peppered with holes from air and gas bubbles. It is the only rock that floats. Though light, pumice has a hardness of 6 on the Mohrs’ scale of hardness.

SEDIMENTARY

Limestone
Formed from the skeletons of sea animals. Chalk is a common form of limestone. Limestone is susceptible to acid rain. Limestone has a hardness of 4.

Sandstone
Formed by grains of sand, small rocks, soil and sea shells that have naturally cemented together in layers. The hardness of sandstone depends on many factors and no two samples may be the same. Whether or not the individual sand grains were well cemented during formation will affect the hardness. While the grains of sand making up the sample may be 7, you may be able to crush the rock in your hand, making it seem soft.

Shale
Clay that has been compacted, forcing the water out results in a hard rock, shale. Shale has a hardness of 7.

Flint
Flint is often found in limestone. It splits in any direction to a sharp edge and was used for arrow, dagger and axe heads. The hardness of Flint is 6.

METAMORPHIC

Marble
Limestone that has been exposed to very high heat and pressure turns to marble. Marble is soft and can be scratched with a knife. Popular for statues and home use, such as countertops. Marble only a 3 on the hardness scale, and not a good choice where there will be much use. Synthetic marble is a much better choice.

Slate
Slate splits into thin sheets, which makes it popular of roof tiles and walkways. Slate was once shale. Slate has hardness between 2.5 and 4.

Many metamorphic rocks are so changed that it is impossible to tell what kind of rock they were originally.