ROCKS & MINERALS:
PRECIOUS COMMODITIES

2014 Eco-Meet

Varsity

The study of rocks and minerals is an appropriate beginning to the appreciation of nature. Rocks provide a looking glass into the past, as far back as 4.5 billion years, to help uncover the mysteries of how the earth was formed. In addition, rocks and minerals are the cornerstone of our present society. At one time flint was carved into fierce arrowheads and tools. Obsidian, viewed as a valuable commodity, was traded between tribes and used as one of the first currencies. Today, coal is used in power plants to generate electricity; building and monuments are erected out of granite, and gold is found adorning many fingers. This study guide provides an overview of many rocks and minerals found in Illinois-- some native and others brought by the movement of the glaciers. Our study begins with a look at what constitutes a rock and a mineral.

A **rock** is made up of 2 or more minerals which have been joined through particular conditions of heat and pressure. In fact, rocks have been referred to as "mineral environments;" some consisting almost entirely of one mineral, while others are a mixture.

Rock Words: There are many common names for rocks; they usually give you an idea of how big a rock is.

Mountain – huge, giant hunk of rock that is still attached to the earth's crust, does not move, tall
Boulder – large, taller than a person
Rock – large, you can get your arms around it or a bit smaller but it is usually jagged
River Rock – round rocks that are along the edge and at the bottom of fast flowing rivers
Stone – medium, you can hold it in two hands
Pebble – small, you can hold it with two fingers, could get stuck in your shoe, and usually rounded
Sand – made up of tiny pieces of rock, grains of sand
Grain – tiny, like a grain of rice or smaller, often found on a beach
Dust – really fine powder that is mixed in with sand or soil
Speck – as in a speck of dirt

A **mineral** is a naturally occurring chemical compound, which can be expressed by a single chemical formula. It may be a single element or a combination of any relatively stable element. At least 3,000 different minerals have been identified, with new ones being discovered each year.

There are several physical properties used to study and identify minerals:

Color –although most people think of color as an important characteristic used to describe a specimen, it is not very useful in identifying a mineral. Some minerals are nearly always the same color such as sulfur (yellow) and azurite (blue); while many minerals come in a variety of colors – the changes caused by slight chemical impurities, or exposure to heat.
Color can change when the mineral is exposed to moisture and air causing the surface to tarnish or oxidize.
Color can be described as metallic or non-metallic.

Metallic colors include:
Golden, golden yellow—gold, pyrite
Bronze—chalcopyrite
Copper, copper-red—copper
Silver, silvery-grey—galena, silver

Non-metallic colors include:
Colorless—quartz, halite, selenite
White, beige, creamy—calcite, gypsum, mica, talc
Green—jade, feldspar
Red, reddish-brown—granite
Black, grey—titanite

Words used to describe the intensity of color: dark, very dark, light, pale, deep, dull, shiny, and bright.

Words used to describe how color is distributed: streaked, splotchy, mottled, speckled, layered, banded.

Luster -This refers to the reflection of light from the mineral's surface.

Words used to describe luster, the way light reflects off of the surface of a mineral.

- sub-metallic
- metallic
- shiny
- shimmering
- frosty
- pearly
- silky
- glassy, vitreous
- resinous, glassy

Specific Gravity – (SG) indicates how many times more an object weighs compared to an equal amount of water.
The SG of silver is 10.5; therefore a bucket of silver would weigh 10.5 times as much as a bucket of water.
This is why we think of metals as being heavy; they are heavy compared to other things that we are used to picking up. This is also known as the **heft** of an object.
The average rock you pick up has an SG of about 2.75 because most of the earth's crust is made up of quartz (SG 2.65), calcite (SG 2.7) and feldspar (SG 2.56)

The following is a list of the Specific Gravity of a number of familiar objects:

Freshly fallen snow	SG 0.16
Corn on the cob	SG 0.72
Granulated sugar	SG 0.85
Water	SG 1.0

Crystal Form – refers to the shape of crystal. When minerals have the time and space to grow into their crystal forms, they grow into beautiful regular shapes that are easy to recognize once you have seen a few examples.

Some words used to describe crystal forms or shapes are:

- Acicular / radiating needles – crystals that grow in fine needles
- Blebs – rounded blobs
- Botryoidal – looks like top of bunch of grapes
- Concretion – spherical, round shape that is solid, the same all the way through or filled with layer or agate
- Cubic – 6 equal square faces
- Dendtritic – branching, tree-like, looks like veins of a leaf
- Dodecahedron – 12 sided, like a 12 sided die

Hardness - A mineral's hardness is determined by its ability to resist scratching and abrasion. A German mineralogist, Friedrich Mohs, established a hardness scale from one to ten, which assigns reference minerals to each number (one being the softest and 10 being the hardest.

Scratching Tools:

- fingernail – (2.2)
- copper penny – (3.5)
- pocket knife or common nail – (5.2)
- piece of glass – (5.5)
- steel file or concrete nail – (7.5)
- corundum – (9)

Rating	Description	Mineral
1 Very Soft	easily crumbles scratched with finger nail	Talc
2 Soft	scratched with finger nail	Gypsum
3 Soft	scratched with copper penny	Calcite
4 Semi Hard	scratched with common nail	Fluorite
5 Hard	scratched with common nail	Apatite
6 Hard	will scratch glass	Feldspar
7 Very Hard	scratched with concrete nail	Quartz
8 Very hard		Topaz
9 Extremely Hard	used in industrial tools	Corundum
10 Hardest	can cut all others	Diamond

Cleavage is when a mineral breaks with smooth, flat surfaces. Cleavage can be described as: **perfect, good, imperfect or poor.**

Fracture is when a mineral breaks, but the surface is not regular, and does not show cleavage. <u>These words describe what a break in a rock or mineral looks like</u>:

- **conchoidal** – curved break like what happens with thick glass or bottle bottom, shell shaped
- **jagged** – metals, sharp point that scratches or snags fingertips
- **splintery** – fibrous
- **uneven** – rough surface, not smooth

<u>Streak</u> refers to the color of the powder a mineral leaves after rubbing it on an unglazed porcelain streak plate. Note that this is not always the same color as the original mineral.

The following minerals and rocks are the ones from which the identification part of the test will be based.

Witherite
Color: white, gray, yellowish-gray
Luster: nonmetallic (glassy)
Hardness: 3-3.5
Cleavage: distinct, one direction
Streak: white

Calcite
Color: white or yellowish
Luster: nonmetallic (dull)
Hardness: 3
Cleavage: perfect in three directions
Streak: white

Fluorite
Color: translucent with tints of purple, green, or yellow
Luster: nonmetallic (glassy)
Hardness: 4
Cleavage: perfect in four directions
Streak: white

Galena
Color: dark gray
Luster: metallic
Hardness: 2.5
Cleavage: perfect in three directions
Streak: dark gray

Gypsum
Color: white, colorless, gray, yellow, red, brown
Luster: nonmetallic (glassy)
Hardness: 1.5-2
Cleavage: perfect in one direction, distinct in two
Streak: white

Limonite
Color: yellow or brown
Luster: nonmetallic (silky to dull)
Hardness: 4-5.5
Cleavage: none
Streak: yellowish brown

Pyrite
Color: pale yellow to brass yellow
Luster: metallic
Hardness: 6-6.5
Cleavage: none
Streak: greenish black

Quartz
Color: white~ colorless~ purple, pink, yellow, brown, black
Luster: nonmetallic (glassy)
Hardness: 7
Cleavage: generally none
Streak: white

Sphalerite
Color: generally black or brown
Luster: nonmetallic (resin like)
Hardness: 3.5-4
Cleavage: perfect in six directions
Streak: light brown

Marcasite
Color: brass-yellow to almost white
Luster: metallic
Hardness: 6-6.5
Cleavage: distinct, two directions
Streak: dark greenish to brownish

Feldspar
Color: most commonly white, pink, or gray-brown
Luster: nonmetallic (pearly or glassy)
Hardness: 6
Cleavage: good in 2 directions at nearly right angles
Streak: white

Rocks:

Three types of rocks:

1. Igneous -Such rock is formed by cooled lava, which either spilled out onto the surface (extrusive igneous rocks) or molten rock, which is trapped below the surface (intrusive igneous rock).

2. Sedimentary -This rock is formed from moderate pressure applied by layers of accumulated sediment. It often consists of deposits of weathered rock fragments.

3. Metamorphic - Such rocks form under conditions of intense heat, pressure, or both which alter the original mineral composition. They are formed at considerable depths within Earth from older rock.

Granite

Igneous rock
Color: usually light in color with easily distinguished gray, white, pink, black, and yellow-brown mineral grains
Hardness: 5.5 and above
Composition: quartz, feldspar, with a few grains of a dark mineral
Use: Because of its resistance, Granite is used in landscape features I monuments, and building stone quarries.

Peridotite

Igneous rock
Color: dull green to black
Hardness: 5.5-6
Composition: olivine, pyroxene, and amphibole
Use: source of valuable minerals

Gneiss

Metamorphic rock
Color: gray to white (general appearance of Granite but distinctly banded)
Hardness: variable
Composition: feldspar, quartz, biotite, and hornblende
Use: Building stone for structural purposes

Quartzite

Metamorphic rock (derived from sandstone)
Color: white, purplish, or yellowish
Hardness: variable but one of the hardest rocks known
Composition: quartz is the dominant mineral
Use: construction

Shale

Sedimentary rock
Color: gray
Hardness: easily scratched by a knife
Composition: clay minerals with grains of quartz and flakes of mica.
Use: Used in the production of ceramic products such as bricks.

Limestone

Sedimentary rock
Color: white to gray
Hardness: 3-4
Composition: 50 % or more Calcite
Use: Limestone is an important ingredient in mortar and cement.

Sandstone

Sedimentary rock
Color: white, gray, yellowish, or dark red
Hardness: variable
Composition: sand grains cemented together
Use: construction and source of glass

Coal

Sedimentary rock
3 types: peat, lignite, and bituminous
Color: yellowish, brown, or black (color varies with type)
Hardness: 1-2.5
Composition: carbon, hydrogen, and oxygen
Use: fossil fuel

Conglomerate

Sedimentary rock (rounded pebbles cemented by finer materials)
Color: highly variable according to composition
Hardness: Also variable according to composition
Composition: Conglomerate may consist of any rock or mineral, but most commonly composed of resistant materials such as quartz, quartzite, and chert.
Use: Ornamental