Materials needed:

Rock and mineral specimens
Granite, Marble, Limestone, Pyrite, Jasper, Hematite, Selenite, Quartz, Copper Ore, Soapstone, Obsidian

Testing tools
Vinegar, Nail, White ceramic tile, Copper Penny

Optional: Wire and string for necklace

YouTube **VIDEO INSTRUCTIONS** at SciWorkshop.org/KITS

1. Examine the mineral and rock specimens – are any of them familiar? Which is your favorite?	2. Read the Rock/Mineral cards and match them to specimens in your collection. Look at the ID flow chart and do a hardness test, streak test, or acid test if you need to! Read tips on testing or watch video
3. When you think you've got them all correctly identified, open the envelope and check the ID Guide… were you right?	4. Polished "mystery stone" gems are included in your kit. Based on what you've learned, what minerals do you think are in them? You can twist some copper wire around a polished stone to create a pendant necklace.
Keep an eye out for interesting rocks in the world around you. You can keep adding to your collection!	

NOTE: Selenite crystals are fragile and pieces easily fall off (and dissolve in water) - best to keep that mineral in the bag. Quartz crystals, on the other hand, are hard and durable!

Any questions? We'd love to hear from you! Reach out to team@sciworkshop.org

Tips and Tricks for testing (see video at Sciworkshop.org/KITS)

STREAK – Rub the mineral across a white ceramic plate to see what color its powder is.

ACID TEST – Drip vinegar on the rock surface and look and listen for CO2 bubbles, or put rock sample in a small cup of vinegar. Rinse and dry afterwards.

HARDNESS – Mohs scale is used to measure minerals from 1 (softest) to 10 (hardest). Use the following objects to do a scratch test for hardness:

Fingernail = 2.5
Copper penny = 3.5
Steel Nail = 5.5

If your fingernail can scratch the surface of the rock, it is below 2.5 in hardness. If the rock leaves a scratch on a copper penny, it is 3.5 or higher in hardness. If the rock scratches the copper penny but a steel nail can leave a scratch in the rock, it is between 3.5 and 5.5 in hardness. If a steel nail cannot scratch the rock (or the rock scratches the steel nail) the rock is 5.5 or higher in hardness.

Basic Geology

What's the difference between a rock, mineral, and gem? A **rock** is made up of one or more minerals that can vary in amount. A **mineral** is a natural element or compound with a characteristic chemical composition, crystal form, and physical properties (color, hardness, shine, etc). A **gem** is a mineral or rock that is valued for its beauty.

Rocks fall into 3 categories: **Igneous**, **Sedimentary**, and **Metamorphic**.

Igneous rocks form from molten rock that cools and solidifies either slowly deep under the ground forming large crystals (intrusive) or is ejected from a volcano and cools rapidly on the surface (extrusive).

Sedimentary Rocks are formed on or near the earth's surface from mineral or organic particles that settle in layers and become cemented together over time.

Metamorphic Rocks start out as another type of rock that becomes denser and more compact by high heat, high pressure, and/or hot fluids. These conditions occur deep inside the earth and where tectonic plates meet. New minerals are created and rocks are squished and folded.

Deep Dive – Learn more!

Minerals.net has an A-Z guide to minerals, filterable by color, hardness, etc.
https://www.minerals.net/

The Open University has several geology courses: https://www.open.edu/openlearn/science-maths-technology/free-courses/

MIT has a free open course Intro to Geology https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-001-introduction-to-geology-fall-2013

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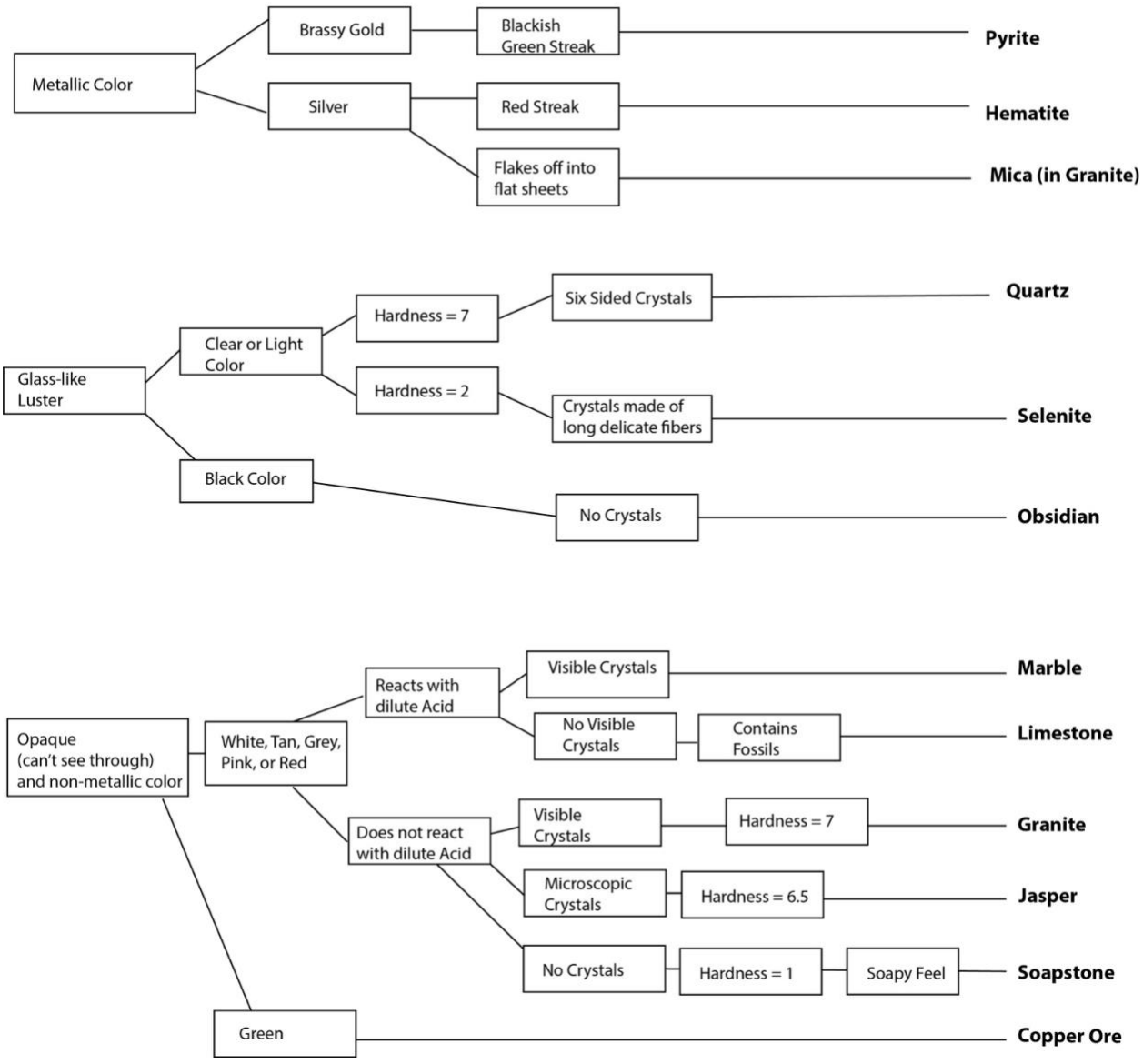
Mineral and Rock Identification Flow-Chart (for Science Kit)



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Soapstone

Soapstone is a **metamorphic rock** that contains a lot (30-80%) of talc, a soft mineral. Soapstone is not damaged by heat or acid and has great thermal properties, holding and radiating warmth. Traditionally used for making cook pots, lamps, stoves, and countertops. If you want to learn to carve stone, soapstone is a good soft stone to start with.

Color: Grey, Bluish Green, Black
Hardness: variable ~1.
Luster: Greasy
Feel: Soapy feeling
Chemical Formula: mostly talc $Mg_3Si_4O_{10}(OH)_2$

Limestone

Limestone is a **sedimentary rock** that forms in warm, shallow waters from old shells composed of calcium carbonate ($CaCO_3$). Shell fragments and mud settle on the bottom and are compacted and cemented into stone over millions of years. Limestone is used to build stone buildings, as an ingredient in cement, in the base of roads, and as a white pigment. Underground caves and caverns are often made of limestone, as the stone is eaten away by acidic rainwater.

Color: White or Tan
Luster: Dull
Hardness: variable ~3.5
Chemical Formula: mostly Calcium Carbonate $CaCO_3$
Fizzes in contact with acid (because of Carbonate)

Marble

Marble is a **metamorphic rock** made of limestone that has been transformed by intense heat and pressure below the surface of the earth. This causes the carbonate minerals to re-crystalize, forming large, visible, sparkling crystals in the stone. The swirls of darker colors come from clay minerals that were in the original sediment. Marble has long been used as a decorative stone for statues and buildings.

Fizzes in contact with acid (because of Carbonate)
Color: White with swirls of tan, grey, black.
Luster: Pearly
Hardness: variable ~4
Chemical formula: Mostly Calcium Carbonate $CaCO_3$
Crystals: Interlocking calcium crystals are visible to the eye

Quartz

A hard crystalline **mineral** abundant in the earth's crust. Most sand is made up of weathered quartz. Crystals are hexagonal (have six sides). Usually quartz crystals are attached to a base rock at the bottom and have one pointy tip. The quartz crystals in this collection are called "Herkimer diamonds" and are special because both ends terminate in a point. Quartz sand is used in glass making, cement, and many industrial processes. Quartz crystals are used as oscillators in clocks, radios, and computers.

Color: Pure Quartz is colorless and clear like glass. Impurities can make it purple (Amethyst), pink (Rose Quartz), grey (Smokey Quartz) or yellow (Citrine)
Luster: Glass-like
Hardness: 7
Chemical formula: Slicon Dioxide (Silica) SiO_2
Crystals: hexagonal

Jasper

Jasper is an **aggregate rock** (mix of minerals) made mostly of micro-crystalline quartz called chalcedony along with impurities that give it a wide range of colors, most often forms of iron. Jasper is an opaque gem, which means you can't see through it. The same rock in a more transparent form (more light can pass through it) is called an agate. Jaspers and agates are gem stones that polish to a beautiful, shiny finish and are popular stones to use in a home rock tumbler.

Color: usually red but also yellow, brown, green, and sometimes blue.
Streak: white
Hardness: 6.5 – 7
Chemical formula: Mostly Silica SiO2 with Iron III

Obsidian

An **igneous rock** that forms so quickly from cooled lava that there is no time for crystals to form, creating a volcanic glass. Breaks into sharp edges. Ancient stone-age cultures around the world valued obsidian because it can be easily shaped into blades and arrow points. Surgeons sometimes use obsidian blades because the edge is much finer than steel and helps with faster healing. Obsidian is also used as a gemstone.

Hardness: 5 – 6
Color: often black or dark
Luster: Glass-like
Chemical formula: mostly Silica (SiO2)
Fractures: Fragile and breaks with sharp edges

Selenite

Selenite are crystals of the **mineral** gypsum. Named after the moon. Soft, can be scratched with a fingernail. Selenite crystals can grow huge – the *Cueva de los cristales* cave in Mexico has a crystal over 36 feet long that weights 55 tons! Selenite crystals form when mineral-rich water evaporates in hot springs, caves, and salt flats. Gypsum is used in drywall boards (in the walls of your house), plaster for patching and casting, and fertilizer for agriculture.

Color: Transparent and colorless, or pearly white.
Luster: Glassy, pearly, silky. Fibrous crystals reflects light in a "cat's eye" effect.
Hardness: 2
Chemical formula: CaSO4 2H2O

Pyrite "Fool's Gold"

Pyrite is a **mineral** with a golden color and metallic luster resembles gold. Creates sparks when struck with steel and the oxidization sometimes causes spontaneous combustion in underground coal mines. Can be confused with real gold. How do you tell the difference? Real gold has a yellow streak and is soft – only 2.5 on Mohs scale, which will not scratch a copper penny.

Color: Brassy yellow
Luster: metallic
Hardness: 6 – 6.5
Streak: Black with a greenish tinge
Crystals: Cubic
Chemical formula: Iron sulfide FeS2

Hematite

Hematite is a **mineral** form of Iron oxide. Hematite was used to paint cave art 164,000 years ago and is still used today as a red and yellow ochre pigment. Hematite is weakly magnetic. If you have a sample of hematite that is magnetic, it probably also contains magnetite (a similar iron ore) which is strongly magnetic. The red color of the planet Mars comes from iron oxides. The Mars Rover Opportunity found round hematite spheres on Mars that are evidence of ancient water.

Color: ranges from red, brown, black, gray, silver.
Streak: All colors of Hematite have a dark red streak
Hardness: 5.5 – 6.5
Chemical formula: Iron Oxide Fe_2O_3

Granite

Granite is an **igneous rock** formed from the slow crystallization of magma (molten rock) deep below the surface. Granite is an important component of the earth's continental crust, the outermost layer of our planet that forms our land masses. Mostly composed of quartz and feldspar, with smaller amounts of mica and other minerals. Feldspar comes in a wide range of colors but the crystals will always be opaque (can't see through them). Granite is widely used as a building material, bridges, monuments, and in countertops and tiles. The granite in this collection includes a lot of mica.

Color: ranging from white, grey, pink, tan, blue, black
Luster: Grainy and variable with particles that are dull, glassy, and metallic
Hardness: 6 – 7
Crystal form: Coarse grained with large interlocked crystals throughout, visible to the naked eye
Chemical formula: mostly Quartz SiO_4 and Feldspar $X(Al,Si)_4O_8$

Mica *

Mica is a **mineral** that easily breaks off and flakes into flexible sheets. Layers of mica are stacked like thin pages in a book. The most common form of mica (light colored) is called Muscovite. Mica is stable when exposed to extreme temperatures, moisture, light, and electricity and has uses in electronics and scientific equipment. Mica has a silvery luster is used as a natural glitter in pearlescent car paints and shimmering makeup.
**Mica is commonly found in igneous and metamorphic rocks. In this collection it is a component of the Granite sample

Color: silvery grey (or black, pinkish, brownish)
Luster: metallic and pearly
Hardness: 2-4
Cleavage: easily flakes off into sheets
Chemical formula: of Muscovite mica, $KAl_2(F,OH)_2$

Copper Ore

Copper Ore is an **aggregate rock** that has copper-containing minerals such as Malachite, Azurite, and Chrysocolla. A green color is a good indication that copper is present. The Statue of Liberty is green because Bronze metal contains copper. When copper metal comes in contact with oxygen, carbon dioxide, and water, it develops a green patina (thin layer on the surface), which is a form of the mineral Malachite. You might see a green patina on copper jewelry as well.

Color: green with other colors from other minerals present
Hardness: 2-6
Chemical formula: of Malachite, $Cu_2CO_3(OH)_2$

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