Barbie™

CRYSTAL GEOLOGY SET

ADVENTURES IN MINERALOGY

THAMES & KOSMOS

Storybook and Experiment Manual

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Safety Information

⚠ **WARNING:**
CHOKING HAZARD — Small parts.
Not for children under 3 yrs. This kit contains functional sharp points or edges. Do not injure yourself! The glasses are a toy, not a safety protective device.

WARNING! Not suitable for children under 4 years. For use under adult supervision. Read the instructions before use, follow them and keep them for reference.
Keep packaging and instructions as they contain important information.

WARNING! Not suitable for children under 3 years. Choking hazard – small parts may be swallowed or inhaled.

When digging out, follow the instructions for use. Keep small children or animals away from the experiment area. Do not eat or drink in the experiment area. The plaster block should be excavated slowly and by wetting it with water, so that dust is not created and pieces do not break off and become airborne. Do not put the plaster material in the mouth or eyes. Clean all equipment and the experiment area after use. Wash your hands after use!

After excavating and cleaning your minerals, you should thoroughly wash your hands and clean your work space. You can dispose of the newspaper with the gypsum remnants in the household trash.

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Technical product development: Thames & Kosmos; Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart, Germany;
Text: Ted McGuire
Copy editing: Dorothy M. Taguchi, PhD, of The Linguistic Edge
All Barbie story illustrations (cover, p. 3, 4, 6, 8-9, 10, 13, 15): Jiyoung An;
Experiment instruction illustrations: p. 5: Dan Freitas; p. 11: Ted McGuire; p. 12: Tanja Donner, Riedlingen; p. 14: Ashley Greenleaf and Ted McGuire;
Other images: Science line drawings (p. 1, 3, 5, 10, 13-15): iStock.com/Marvid; p. 16 pyrite tr, amethyst ml, and quartz bl: Michael Flaig, pro-studios; p. 16 microchip: Matt Gibbs; p. 16 amethyst tl: jonnysek, ©fotolia.com; p. 16 quartz mr: theartofphoto, ©fotolia.com; p. 16 pyrite mr: Rainer Walter Schmied; p. 16 iron: Wolfgang Sauber, © Wikipedia, CC-BY-SA-3.0;
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Printed in Taiwan / Imprimé en Taiwan

A Word to Parents and Supervising Adults

Dear Parents,

Crystals, rocks, minerals, and gemstones have fascinated people of all ages for thousands of years. This kit, along with the illustrated story and instructions in this manual, provides an engaging way to teach children ages 4 and up about mineral geology and Earth science.

Please support your child in his or her science experiments and help him or her with both advice and in physically performing experimental steps when help is needed.

Before starting the experiments, please read the instructions. Follow the instructions and keep them for reference.

Make sure that no parts of this experiment kit get into the hands of children younger than 4 years old, and children without adult supervision — in particular, the pieces of plaster gypsum remaining after the excavation of the minerals. These can be disposed of in the household garbage.

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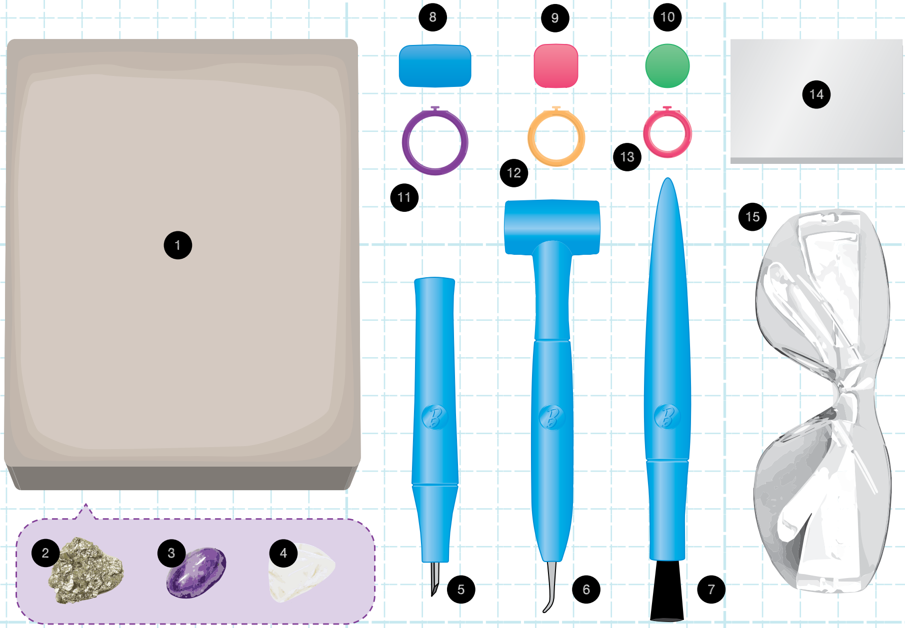
Kit Contents



✔	No.	Description	Quantity	Item No.
❍	1	Plaster block	1	719 130
❍	2	Pyrite specimen (inside block)	1	719 143
❍	3	Amethyst specimen (inside block)	1	719 141
❍	4	Quartz specimen (inside block)	1	719 142
❍	5	Chisel tool	1	775 284
❍	6	Hammer/pick tool	1	775 283
❍	7	Brush tool	1	775 285
❍	8	Large mounting plate*	1	719 139
❍	9	Medium mounting plate*	1	719 138
❍	10	Small mounting plate*	1	719 137
❍	11	Large ring*	1	719 136
❍	12	Medium ring*	1	719 135
❍	13	Small ring*	1	719 134
❍	14	Sheet of adhesive double-sided tape	1	719 140
❍	15	Toy safety glasses	1	719 129

For some experiments, you will also need: *table salt, tablespoon, water, pencil, small glass jar (1 cup volume), string, cooking pot, stove, spoon, paper towel, newspaper, cup, ruler, flashlight, ceramic cup, scissors*

*Note: Colors of rings and plates will vary.

THE STORY BEGINS . . .

“Wow! Look at this one!” Barbie exclaimed, gesturing for Nikki to come over and look. The girls were in Barbie’s grandmother’s library admiring her collection of rocks, minerals, and gemstones of all shapes, sizes, and colors. They had been collected from all over the world. Barbie pointed to a gorgeous purple stone with many flat faces that reflected the light in a stunning way.

“I would love to have a beautiful crystal like this,” Barbie said.

“I grew crystals with salt for a science class project once,” Nikki responded. “Let’s try making our own crystals!”

The girls went to Nikki's house and into the kitchen. They measured out an amount of table salt and poured it into a bowl of hot water. Then they added a little food coloring and stirred it up. The salt dissolved into the water.

"We'll have crystal gemstones in no time!" Barbie beamed.

But nothing appeared to happen. The girls waited for about an hour and still nothing had happened. They decided to take a break from crystal growing and do some homework.

A few days later, Nikki called Barbie. "Barbie, I have an update: Some of the salt crystals grew over the past few days, but they are really small and they break apart easily. They don't look like the crystals in your grandma's collection!"

"Hmm. What is the difference between the hard gemstones in Grandma's collection and those salt crystals?" Barbie wondered.

"I remember seeing gemstones at the natural history museum. Let's go there and see what we can find out," Nikki responded.

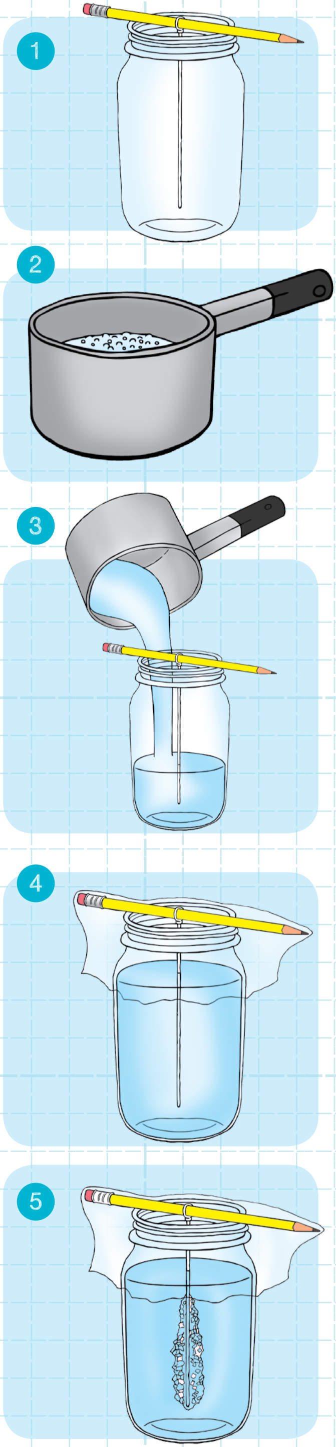
Salt Crystals

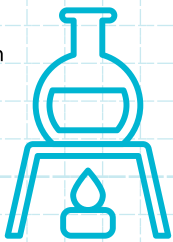
This is an optional experiment so you can see for yourself how crystals form from a salt solution.

> **Safety Note:** Caution! High temperatures. There is a risk of burns. Adult supervision is required.

You will need: *table salt, tablespoon, water, pencil, small glass jar (1 cup volume), string, cooking pot, stove, spoon, paper towel*

1. Prepare by tying a string around the middle of a pencil. When the pencil is placed across the top of the jar, the string should hang down into the jar but not touch the bottom.
2. Pour a half cup of water into the cooking pot. Have an adult help you heat the water on the stove until it boils. Stir 1 tablespoon of salt into the water. Stir until the salt dissolves (or disappears) in the water. One at a time, continue to add tablespoons of salt to the water until no more salt can be dissolved and some salt remains at the bottom of the pot.
3. Remove the pot from the heat and let it cool a little. Pour the solution into the jar. Make sure the string hangs down into the solution.
4. Cover the jar loosely with a paper towel, but do not make it airtight.
5. Leave the jar in a spot where it will not be disturbed. After a few days, you should see some small crystals form on the string. For larger crystals, wait a week or longer.





At the natural history museum, the girls looked at displays of unbelievable gemstones from around the world. While they were examining an impressive blue crystal from South America, a geologist who worked at the museum came around the corner. “Hello, girls. That’s a beautiful specimen, isn’t it?” She said.

“Yes, it’s amazing,” Nikki replied. “How can we grow a crystal like this? We tried to make one at home, but it didn’t work very well.”

“Crystals like this are formed over millions of years, deep inside the ,” the geologist explained. “It requires huge pressures and temperatures. It would be impossible to make them at home.

“My name is Trisha and I’m a staff geologist here at the museum,” she continued. “Geologists study the solid Earth, the rocks inside it, and the processes that act on those rocks. Here, let me tell you a little about crystals, rocks, minerals, and the rock cycle.”

"Certain rocks and minerals have fascinated people for ages because of how they form regular patterns known as **crystals.** Long ago, people didn't know how these special crystal shapes formed. Today, we know that they are created by the forces of attraction between their smallest building blocks, called **atoms.** That's what determines a mineral's specific crystalline shape.

"Rocks are made of combinations of different **elements.** All gems and **minerals** are rocks, too. A mineral is just a rock that is purely composed of one element.

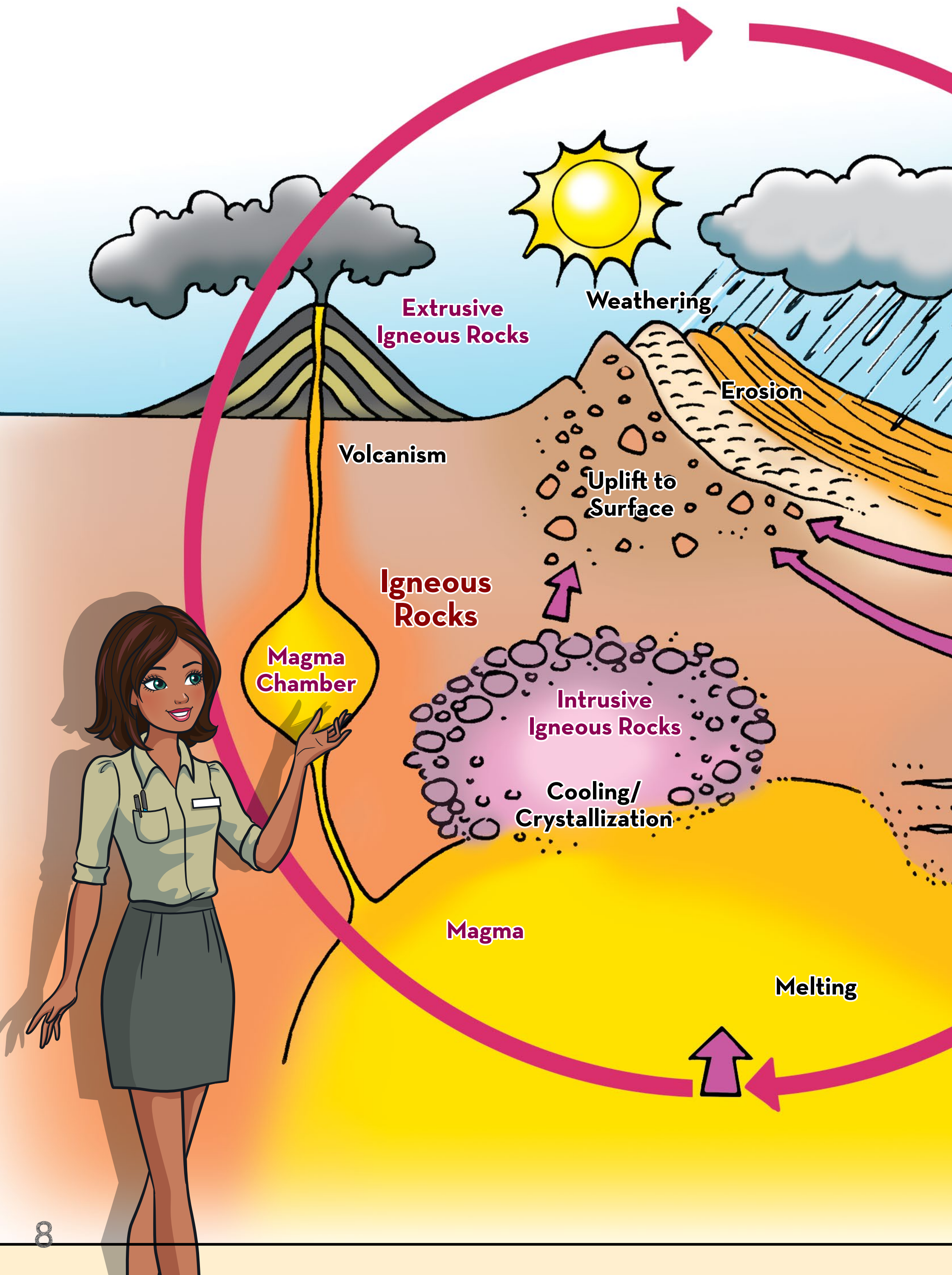
As you read this page, follow along in the diagram on the next page!

"There are three main types of rocks: **igneous, sedimentary,** and **metamorphic.** The three different types of rocks transform from one to another over long periods of time. This is called the **rock cycle.**

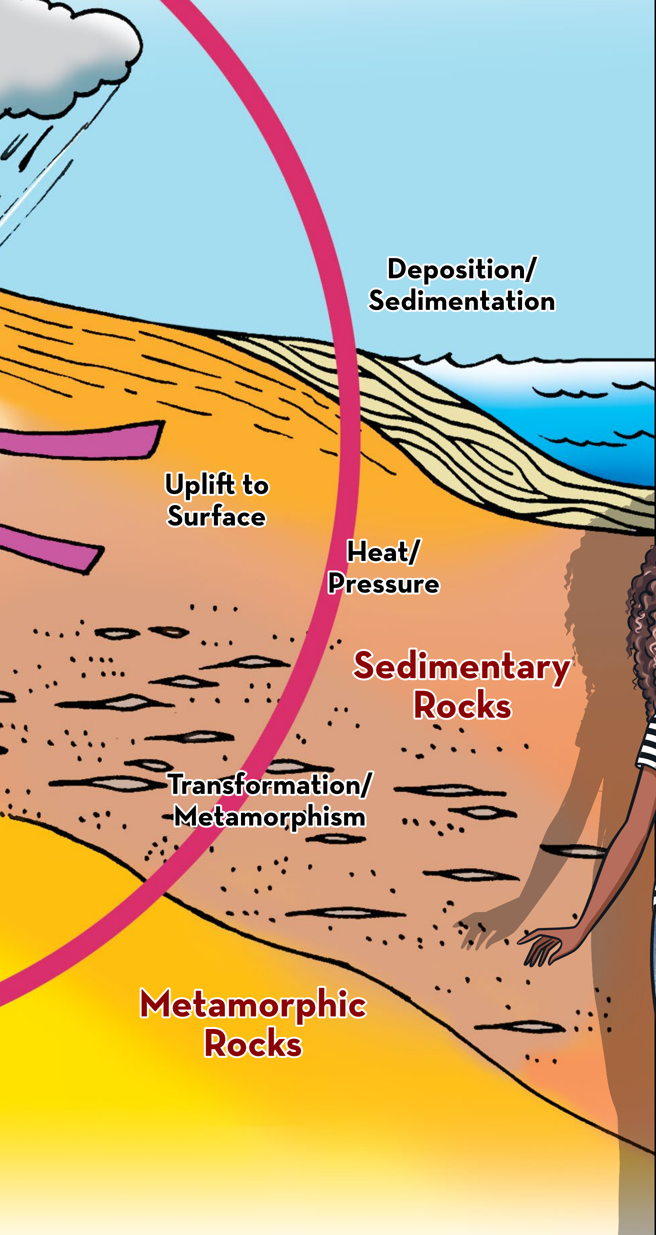
"Let's start deep in the Earth: When minerals in the Earth are under a lot of **pressure,** they heat up and turn to liquid. This hot liquid is called **magma. Igneous rocks** form when magma cools down inside the Earth and crystallizes. Igneous rocks can also form when magma pours out onto the Earth's surface as **lava,** and cools and crystallizes. The faster a rock crystallizes, the smaller its crystals.

"Rocks on the surface of the Earth are subject to **weathering** and **erosion.** The wind and water slowly wear rocks down into small pieces of rock, called **sediment.** Erosion is the process by which sediment is moved by air or water to new places. This sediment then settles and builds up, layer by layer, and over time, gets compressed into hard **sedimentary rock.**

"Igneous and sedimentary rock can form into **metamorphic rock** if they are subject to a lot of heat and pressure under the Earth's surface. The rock doesn't melt first as with igneous rock, but its crystal structure changes. Rocks can turn back into magma again under extreme heat and pressure, and then the cycle can repeat. This whole cycle acts on the scale of millions of years."


Extrusive
Igneous Rocks
Weathering
Erosion
Volcanism
Uplift to
Surface
Igneous
Rocks
Magma
Chamber
Intrusive
Igneous Rocks
Cooling/
Crystallization
Magma
Melting

THE ROCK CYCLE



"I'd love to learn more about rocks and minerals," Barbie said.

"I have an idea," the geologist said. "If your science teacher agrees, we could arrange to take your whole class on a geological field trip to learn all about rocks and minerals, and, of course, gemstones."

"Oh, yes! That would be so cool!" Nikki said.

On the day of the field trip, Barbie, Nikki, their classmates, and their teacher met the geologist and took a bus to a rocky state park outside their town.

"Today, we're going to hunt for rocks and we're going to learn how to use their properties to identify them," said the geologist. "First, let's find some rocks to identify."

"I found a big sedimentary rock," Barbie said holding up the rock. "Let's use our rock hunting tools to dig into it and see if we can find any other special rocks instead."

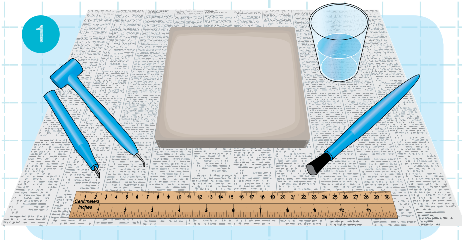
"Good idea," said the teacher. "A sedimentary rock made up of other big rocks that are held together by natural cements is called a conglomerate."

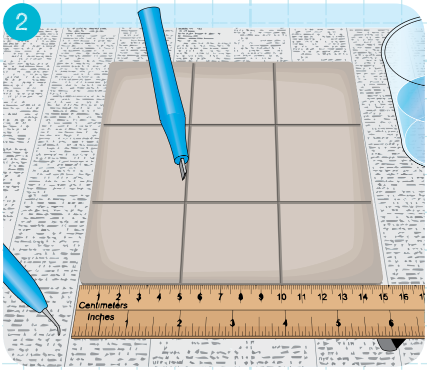
EXPERIMENT

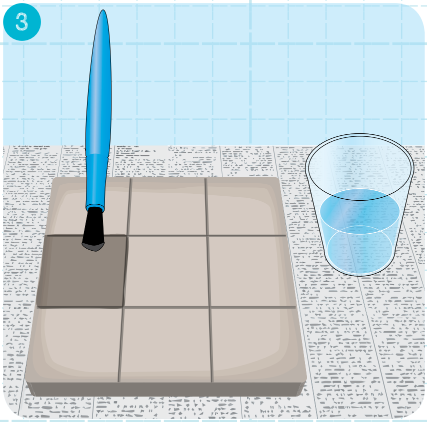
Excavating the minerals

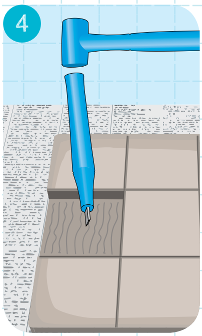
You will need: plaster block, chisel tool, hammer/pick tool, brush tool, *newspaper, water, cup, ruler*

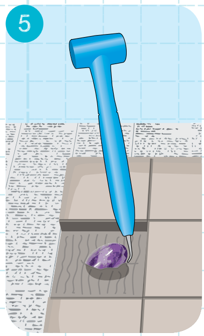
1. Prepare your workspace. Lay newspaper down to protect the table. Get your tools ready.
2. With a ruler and the chisel, etch lines into the surface of the plaster block to form a grid pattern. The grid can be three by three rectangles.
3. With the brush tool, wet one of the rectangles to soften the plaster there.
4. Use the chisel and pick tools to scrape away the material in this rectangle. Use the hammer and chisel tools to break through slightly harder areas.
5. As soon as you find something, start digging carefully around it. Clean it off with the brush tool.
6. Continue around the block until you have found all the minerals in the block. Clean the minerals completely with water.
7. Use the mineral information on page 16 to identify the three minerals you found.

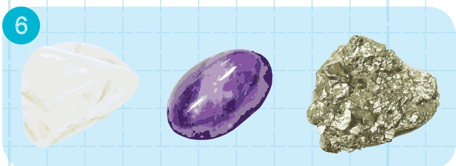












"Wow, look at these beautiful rocks that were deposited inside that sedimentary rock," Nikki said. "But how do we know what they are?"

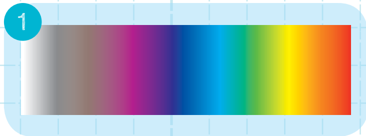
"Let's do some experiments to find out," replied the geologist.

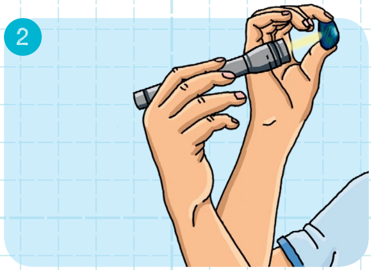
The geologist proceeded to show the students the various mineral identification tests: color, luster, hardness, streak, cleavage/fracture, specific gravity, acid test, and magnetism test.

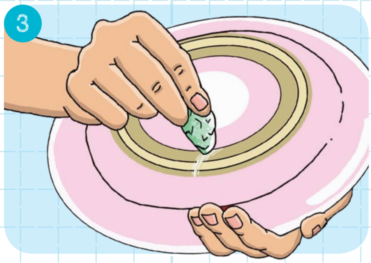
EXPERIMENT

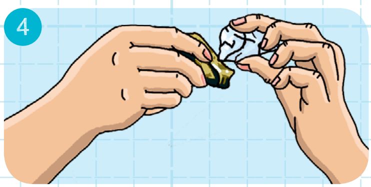
Mineral Identification Tests

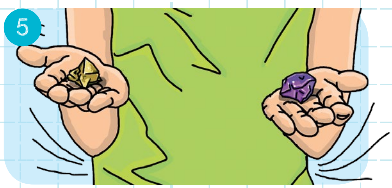
1. **Color:** What is the color of the surface of the mineral?
2. **Luster:** What is the quality of the light reflected from the surface? Is it shiny, dull, or metallic?
3. **Streak:** Scratch the mineral on an unglazed ceramic surface, like the bottom of a plate. If the mineral leaves behind a streak, the color of the streak can be used to identify it.
4. **Hardness:** A mineral's resistance to scratching is measured on a scale of 1 to 10, with the most easily scratched minerals, like talc and gypsum at 1 and 2, and the hardest minerals, like diamond, at 10.
5. **Specific Gravity:** This is a measure of the density of a mineral, or its weight per a specific volume. Compare the weight of two minerals in your hand. Which is heavier?
6. **Acid Test:** Some minerals will react to acids, like vinegar, and fizz when vinegar is dripped on them.
7. **Magnetism Test:** Some minerals are magnetic and will attract iron.











When the girls finished identifying all of the minerals, they joined their classmates, who were still hunting for rocks. Nikki started excavating a new area of dry, beige-colored stone.

"I've found a really weird looking rock in here," said Nikki. "Come look at this."

"That's not a rock – that's a fossil!" exclaimed the geologist excitedly. "It looks like you've found a dinosaur bone!"

"Did dinosaurs really live around here?" asked Barbie.

"Yes, a long time ago," explained the geologist. "And when they died, their bodies were covered in sediment. Over a long period of time, the softer minerals of their bones eroded away and were replaced with harder rock crystals. These stayed inside the Earth for a long time – until they came back up to the surface."

"Let's take this bone to the natural history museum and see if we can identify it," the teacher said.

"And later we can take these other minerals home and make something cool out of them!" Nikki said.

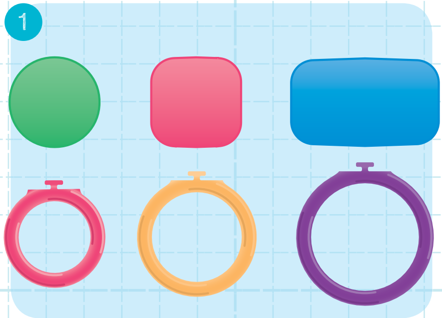
THE END

EXPERIMENT

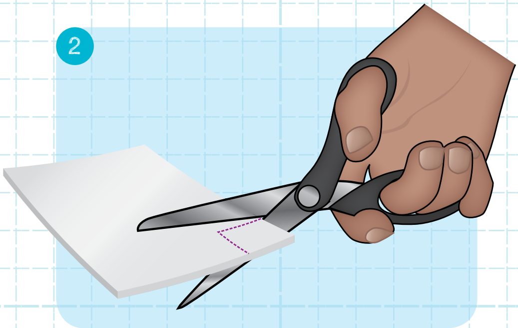
Mounting the Minerals on the Rings

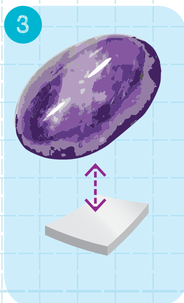
You will need: ring mounting plates, rings, double-sided adhesive tape, minerals from inside the plaster block, *scissors*

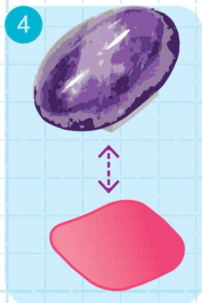
1. Decide which ring and mounting plate you want to use. The rings are different sizes to fit differently sized fingers. The mounting plates are different sizes to fit different minerals.
2. Have an adult help you cut a small piece of double-sided taped that will be big enough to hold the mineral, but small enough to not stick out too much from the bottom edges of the mineral.
3. Peel off the double-sided tape's backing paper and stick it to the flattest side of the mineral.
4. Now affix the mineral with the tape to the mounting plate. Press it down firmly.
5. Slide the mounting plate onto the top of the ring. The ring is done!

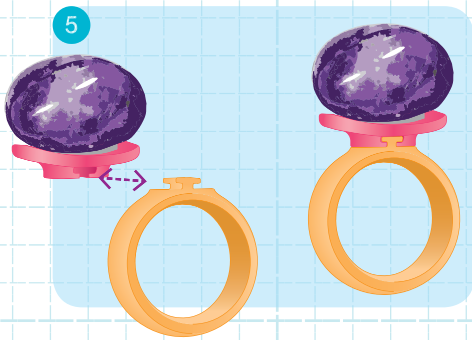


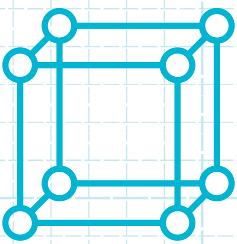
Colors will vary.









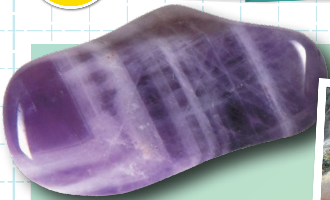


Barbie and Nikki devised a way to mount the most interesting mineral onto a ring setting. They put the rest of the minerals into their display case and labeled them to start their rock collection. They couldn't wait to go out and find and identify new specimens.

"That ring is so gorgeous," Nikki remarked.

"Thank you. I love it," Barbie said, admiring the ring on her finger. "It's my favorite ring because it reminds me of all the interesting things we found and learned on our geological field trip!"

WHAT'S HAPPENING?



Traces of iron

Amethyst

This beautiful purple stone is a member of the large quartz group. It contains traces of iron — a few hundredths of one percent. These iron atoms became altered by exposure to natural radiation in such a way that they produce a purple color (otherwise, iron will create a green or brown color). It is possible to estimate how long the radiation has to work to produce visible violet coloring: approximately five million years!

Amethyst is often found underground in the form of large crystal deposits. These veins can contain caverns that are lined with amethyst crystals of all sizes.

In Brazil, it is not uncommon to find meter-long rock cavities lined with amethyst crystals. There is also a famous 400-meter-long amethyst gorge in the Austrian town of Maissau — which inspired the locals to choose purple as their town color.

Hardness	Density
7	2.6

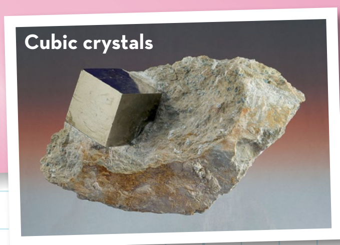
Pyrite

The brassy, shiny metallic nuggets of this mineral contain no gold — even though gold prospectors used to be fooled by them every once in a while. That's why pyrite is also known as "fool's gold!"

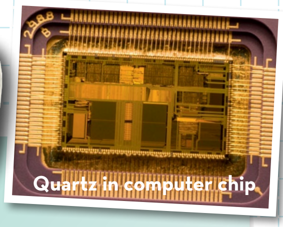
It is an example of an ore, which is a mineral from which a certain metal can be obtained. In this case, the metal is iron — chemically bonded in a compound with sulfur. Pyrite often forms pretty cubic crystal shapes.

Pyrite can be found in many parts of the world. The chemical industry uses small amounts of it in the manufacture of sulfur compounds.

Hardness	Density
6	5



Cubic crystals



Quartz in computer chip

Quartz

Hardness	Density
7	2.6

The ancient Greeks imagined quartz crystals to be a kind of ice that once got so cold that it could not melt again. They called it "*krustallos*," which means both "ice" and "rock crystal" in ancient Greek and from which our word "crystal" derives.

In fact, these crystals consist of pure, clear quartz — one of the most common substances in Earth's crust and a component of many different kinds of rock. It is used in the production of computer chips, glass, and porcelain. Artificially cultivated quartz crystals are used to keep precise time in quartz clocks.

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