



Be a Scientist!

A diamond is a kind of crystal that forms deep underground. Use simple materials to model how crystals form. Add sugar to a cup of water, a little bit at a time. Stir it each time you add sugar. Stop adding sugar when no more sugar will dissolve in the water. With an adult's help, heat the water to dissolve the rest of the sugar in the cup.

Place a string or a toothpick in the water. Watch what happens over the next few days. Compare what you observe to what you know about how diamonds form.

Repeat this activity. Change the materials you use to try making different crystals. Make notes and present your findings to the class.



Beyond the Book

Research a gemstone other than diamonds. How does it form? Is it used for anything other than jewelry?

FOCUS Book



Diamonds



: Science A-Z 



Diamonds



FOCUS Question

How do diamonds form?

Cause and Effect

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Diamonds

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What Is a Diamond?

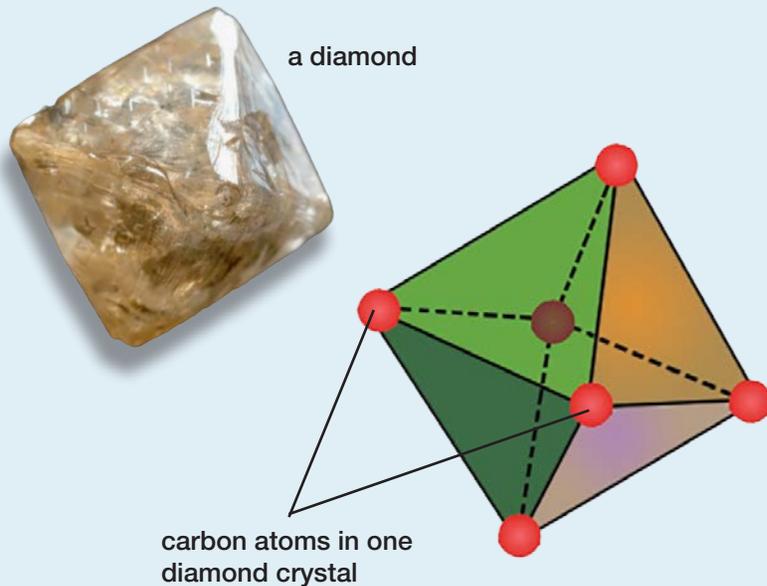
Have you ever seen a diamond? It is a beautiful gemstone. Not all diamonds are clear and sparkly, however. Some are dull. They can be brown, gray, or black. They can even be white, yellow, or pink. No matter what color, all diamonds are minerals made of the element *carbon*.

Like many other minerals, diamonds are crystals. Crystals are organized groups of atoms. The shape of a crystal depends on how the atoms are arranged. Most crystals have straight edges and smooth sides. Each side is called a *face*.



Diamonds can be many different colors. They are often cut into different shapes to be used in jewelry.

Getting Into Shape



Diamond crystals usually have eight faces. Their crystals are *octahedrons* (ock-tuh-HE-drums). They look like two four-sided pyramids, stuck together bottom to bottom.

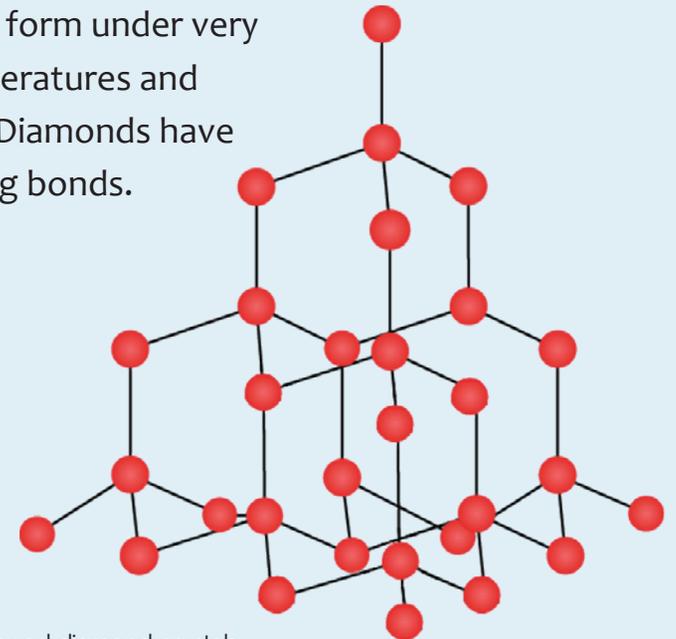
X-ray pictures help us see how diamonds get their shape. The diagram above shows carbon atoms in a diamond crystal. Compare it to the shape of the diamond. The pattern of atoms in one crystal is the same as the shape of the whole diamond.

A Tale of Two Carbons

Diamonds are not the only minerals that are made of carbon. Graphite is also made of pure carbon. Why are diamonds and graphite so different?

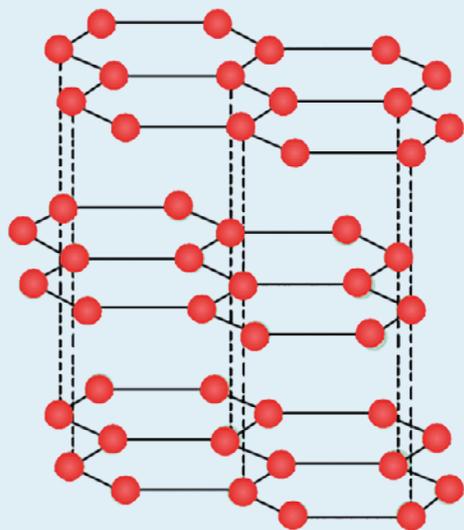
A *bond* attaches one atom to another atom. Atoms can bond to each other in different ways. Some bonds are weak. Some are strong. The way a crystal forms affects the strength of bonds that attach atoms together.

Diamonds form under very high temperatures and pressure. Diamonds have very strong bonds.



Octahedral-shaped diamond crystals join together and form a "honeycomb." This shape makes diamonds very hard.

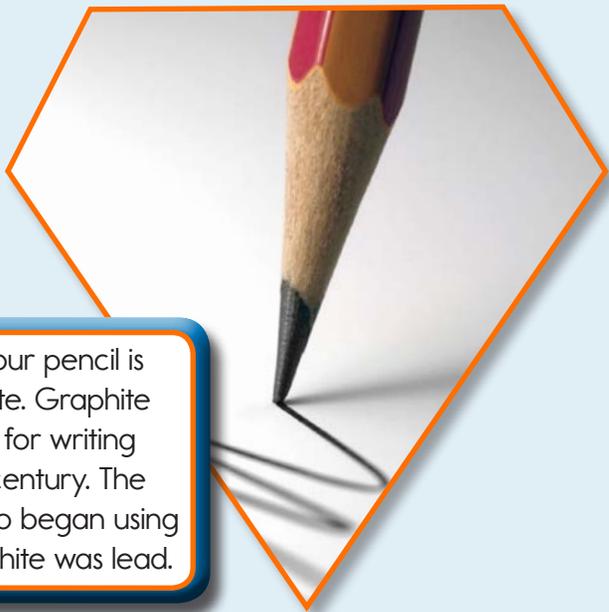
Graphite forms under much lower temperatures and pressure than diamonds do. The bonds that attach the carbon atoms in graphite crystals are much weaker. This makes graphite soft and slippery. These properties make graphite good for use in pencils.



Graphite's atoms bond in flat layers connected by weak bonds. This makes graphite much softer than diamonds.

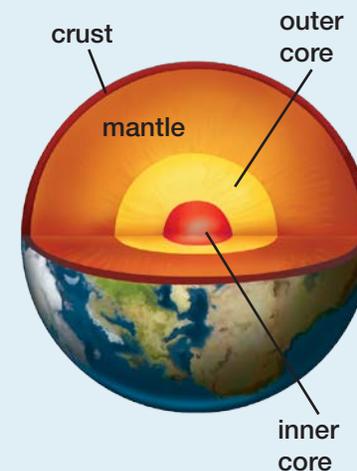
Science in Your World

The "lead" in your pencil is actually graphite. Graphite has been used for writing since the 16th century. The Englishmen who began using it thought graphite was lead.



Super Crystals!

Earth's outer layer is the *crust*. Under it is the *mantle*. Diamonds form in the mantle, about 160 kilometers (100 mi.) below Earth's surface. There, rock is under a lot of pressure because of the heavy rock above it. It is also very hot.



It is so hot in Earth's mantle that some of the rock melts and turns into *magma*. Diamonds form as magma cools and turns back into solid rock. If the magma cools slowly, the diamond crystal grows bigger. This happens because there is more time for carbon atoms to bond together. If the magma cools quickly, crystals do not have as much time to form. The diamonds are smaller.



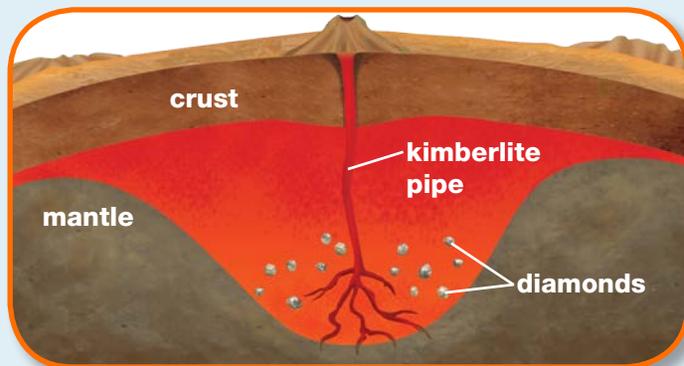
diamond in rock

To the Surface!

Billions of years ago, Earth was much hotter than it is today. Our planet was covered with volcanoes and lava.

Because Earth was hotter, volcanic eruptions were much more explosive than the eruptions we see today. They also happened much deeper in the crust. Magma would travel to Earth's surface through "pipes" in the crust. Diamonds would shoot out of Earth's mantle with the magma!

Magma on Earth's surface is called *lava*. Lava from ancient eruptions cooled and formed rocks called *kimberlites*. Many of Earth's diamonds are found in kimberlites.



Diamonds form at a depth of about 160 km. Volcanic eruptions may bring them to Earth's surface. Diamonds can be found in some surface rocks called *kimberlites*.



Finding Diamonds

Earth has changed since diamonds came out of volcanoes. Earth is much cooler now. Rocks that contained diamonds have been broken down by *weathering*. Rivers have washed diamonds away from the old volcanoes. Diamonds might be found in areas of loose rocks, such as riverbeds, beaches, and fields.

Do You Know?

The Hope Diamond may not be the world's largest diamond, but it is one of the most impressive and famous. People have found only a few large, blue diamonds.



Diamonds are also mined from underground. Diamond mines are located in Russia, India, Canada, the United States, Australia, and some African countries.

Looking for diamonds in a river



Industrial Uses



Diamonds are the hardest minerals on Earth. Nothing can scratch them. This makes them useful for tough jobs.

In fact, about 80% of diamonds do not get used for jewelry. They may be too small or not colorful enough to be gems. Perhaps they are not clear. These diamonds get used in other ways.

Some diamonds are used on blades that can cut through hard materials. Others are used to make drill bits. They can drill through almost anything. Its hardness is what gave the mineral its name. *Diamond* comes from a Greek word that means “unbreakable.”



Diamond-tipped drill bits can drill through very hard materials.

Read-Think-Write

Write your answers on separate paper. Use details from the text as evidence.

- 1 How many sides does an *octahedron* have?
 - A 4
 - B 6
 - C 8
- 2 How are the crystal structures of diamond and graphite different?
- 3 Compare and contrast how graphite and diamonds each form.
- 4 Would you be likely to find diamonds in a place protected from weathering? Explain why or why not.
- 5 If diamonds are the hardest minerals on Earth, how do you think people cut diamonds into different shapes?

FOCUS Question

How do diamonds form? Write a list of steps to explain the process.

