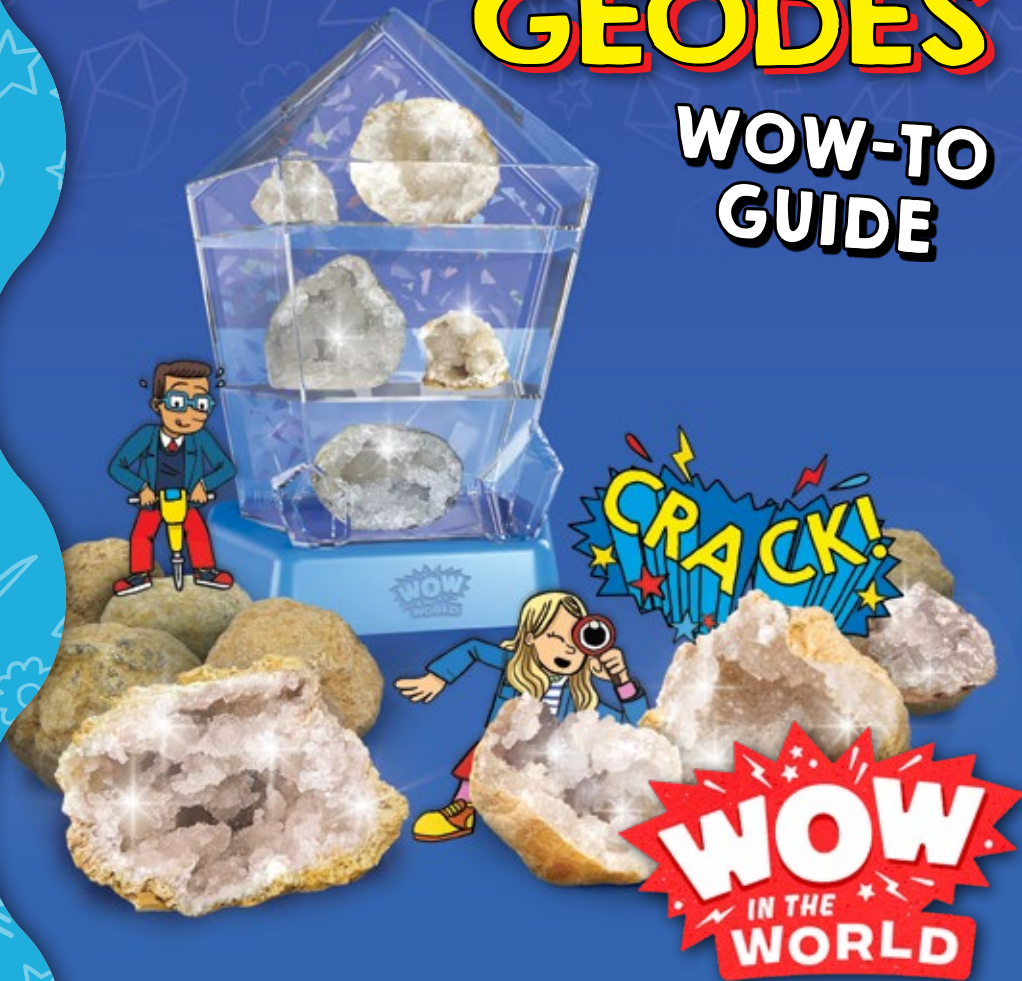


WONDERY  
KIDS

BREAK-OPEN  
**CRYSTAL  
GEODES**

**WOW-TO  
GUIDE**



THAMES & KOSMOS

# SAFETY INFORMATION



## CAUTION:

Broken geodes may have sharp edges or points. Adult supervision required.

Warning! Always wear eye protection. Eye protection for supervising adults is not included. Keep young children, animals and those not wearing eye protection away from the experimental area.

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

The geodes in this kit are naturally occurring specimens that are sourced from the ground. We cannot make any guarantees as to the quality or composition of the contents. Please exercise caution when working with natural materials. Do not ingest the materials and wash your hands after experimenting.

**Have any questions? Missing any parts? Want to tell us a joke?** Our tech support team will be glad to help you!

Keep the packaging and instructions as they contain important information.

**WARNING!** Never look directly into the sun, either with your naked eye or through the magnifying glass. You could blind yourself! Never leave the magnifying glass unattended in the sun. Fire danger!

The process of breaking geodes open can produce dust and airborne rock fragments. Be careful not to breath any dust. We recommend working outside or in a well-ventilated space.

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# KIT CONTENTS



DECORATE YOUR DISPLAY CASE WITH THE STICKERS!

Part No.	Description	Quantity
1	Geode specimen (approximately 1.2 to 2 inches long)	10
2	Display case (3 pieces)	1
3	Safety goggles	1
4	Small magnifying glass with clip	1
5	Sticker sheet	1

YOU WILL ALSO NEED: A HAMMER AND CHISEL, OR A HAMMER AND AN OLD SOCK

# INTRODUCTION

WELCOME TO YOUR CRYSTAL GEODES WOW-TO GUIDE!



GUY RAZ  
(WOW IN THE WORLD HOST)



MINDY THOMAS  
(WOW IN THE WORLD HOST)

A GEODE IS A HOLLOW STONE LINED WITH SHINY CRYSTALS INSIDE!

BUT THE ONLY WAY TO FIND THEM IS BY BREAKING IN FROM THE OUTSIDE! THIS GUIDE WILL HELP YOU.



ALSO, BE SURE TO USE THE QR CODE BELOW TO HEAR SOME WOW-WORTHY GEODE FACTS, FROM US!

OH, AND WE INCLUDED A SPECIAL DISPLAY CASE FOR ALL OF YOUR GEODES TO SPARKLE, SHINE, AND WOW!



Wow in the World is the #1 kids science podcast, hosted by Guy Raz and Mindy Thomas!



- 1 Grown-ups! Scan this QR code to start your **audio journey**.
- 2 Listen to **Track 1**, a *Wow in the World* Bonus Episode!
- 3 Unlock exclusive **Wow Facts** from Guy & Mindy when you see this symbol in the guide!



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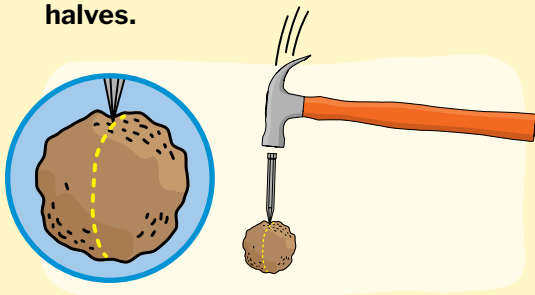


# BREAKING OPEN THE GEODES

Make sure you have read all safety warnings before starting. Always wear **safety goggles**. Adult supervision is required. It can often take several tries to crack open a geode, and kids often need help from an adult. Break your geodes on a hard surface such as a concrete or stone area. Make sure it is okay if the surface takes a little damage, like scratches or chips.

## Using a hammer and chisel

Use this method for the highest likelihood of getting **large geode halves**.



Place the **geode** on the **hard surface**.

Using a **hammer and chisel**, create a **scoring line** around the middle of the geode. Tap with enough force to chip the outside, but not to crush the whole geode to bits. As you work your way around, a crack will form. Continue to chisel along the crack until it breaks open.



## Using a hammer and sock

This is an **easier and safer** method for younger kids. It will prevent geode pieces from flying around, but the resulting pieces may be smaller.



Put the geode into an **old sock**. Place it on the **hard surface**. Hit it through the sock with the **hammer** — gently at first and then a little harder — until it breaks. Remove the pieces from the sock.



**WOW FACT** #2  
“The largest geode ever”

# INVESTIGATING YOUR GEODES

Examine your opened geodes with the **magnifying glass** under bright lighting. What do you see? Record your observations on page 8.



**What's going on here?**



QUARTZ GEODE

A **GEODE** is a **ROCK FORMATION** WITH **CRYSTALS** INSIDE. A **CRYSTAL** is a special kind of rock that has a **NEAT AND ORGANIZED STRUCTURE OF TINY PARTICLES** called **MOLECULES**. It can be transparent or shiny. Some crystals, like the sparkly gemstones you might have seen, are really beautiful and come in different shapes.

Geodes are usually formed in **VOLCANIC ROCK**. As the lava flow cools, **GAS BUBBLES** form, which can create cavities with diameters ranging from a few centimeters to several meters. **WATER** containing lots of **MINERALS** then seeps into these cavities and **CRYSTALLIZES** over time. The crystal-filled bubbles become geodes.

Geodes can be made of **MANY DIFFERENT TYPES OF MINERALS** and can have different **IMPURITIES**, resulting in many different colors. Clear **QUARTZ** and purple **AMETHYST** geodes are common. See page 9 for examples of different geodes.

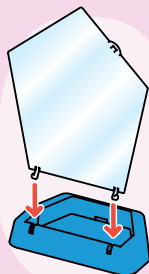
**WOW FACT**



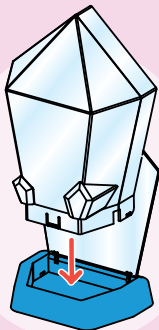
**"Every geode is unique"**

# SETTING UP YOUR DISPLAY CASE

- 1** Snap the **back panel** into the **base** as shown. **Push hard** until it clicks.



- 2** Slide the **main case piece** into the **base** as shown.



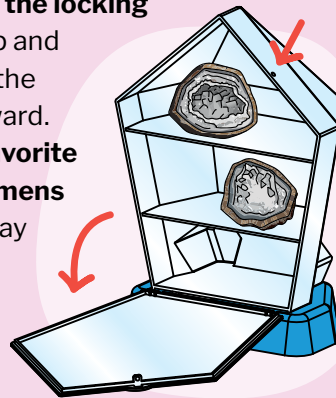
**WOW FACT**



**"Hold me closer, tiny hammer"**

- 3** Open the back panel of the display case by **pushing in and down on the locking tab** at the top and then folding the panel downward. Place your **favorite geode specimens** into the display case for safe keeping.

PUSH IN AND DOWN ON THE LOCKING TAB



- 4** Decorate the display case with the included **stickers**!



## WHERE ON EARTH ARE GEODES FOUND?

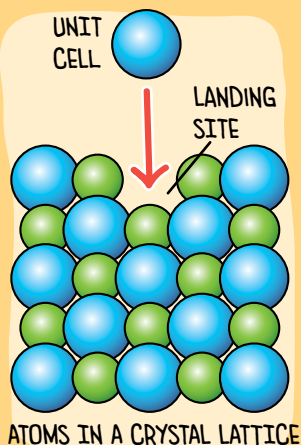
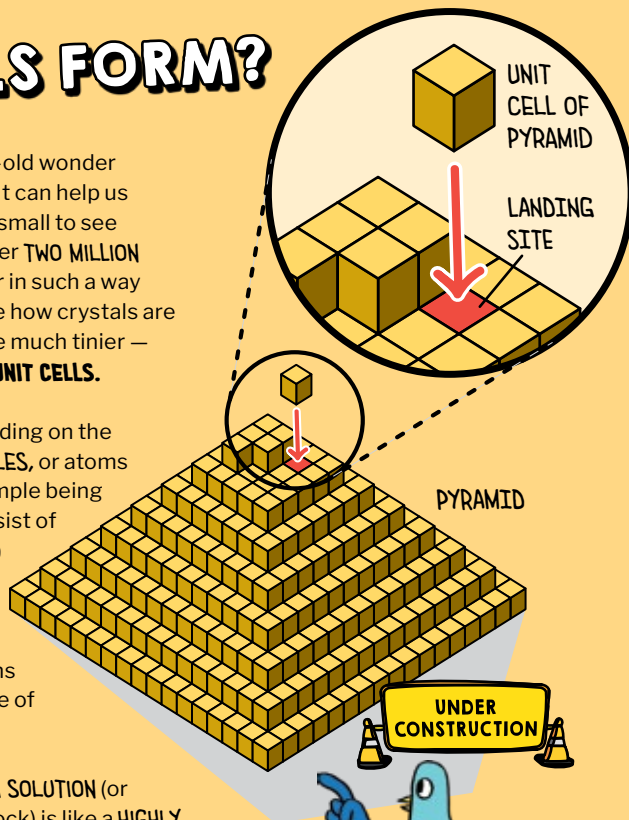


Geodes can be found wherever the geological conditions are suitable for them to form. Many of the geodes that are sold commercially come from Brazil, Uruguay, Mexico, and Namibia. Brazil, in particular, is known for amethyst geodes that are several meters tall, found in the large igneous province (an accumulation of igneous rocks) called the Paraná-Etendeka traps. Geodes are also found in North America and England, where they are sometimes called "potato stones."

# HOW DO CRYSTALS FORM?

The **GREAT PYRAMID OF GIZA** in Egypt, a 4,000-year-old wonder of the world, is like a **GIGANTIC MODEL OF A CRYSTAL**. It can help us understand the structure of a crystal, which is too small to see with the naked eye. This pyramid was built from over **TWO MILLION RECTANGULAR BLOCKS** stacked on top of one another in such a way that they form the pyramid's shape. This is a lot like how crystals are formed, except in their case the building blocks are much tinier — not much bigger than atoms. These are known as **UNIT CELLS**.

Unit cells can be assembled in various ways depending on the type of material involved. Some consist of **MOLECULES**, or atoms connected to each other in a certain way (one example being **ROCK CANDY**). With other substances, they can consist of nothing but identical **ATOMS** (this applies to **DIAMOND** crystals, for example, which are composed only of carbon atoms). In addition, unit cells can be made of **IONS**, which are electrically charged atoms or groups of atoms. Substances made of ions are known as **SALTS** — like **TABLE SALT**, which is made of sodium and chloride ions.



A **CRYSTAL FORMING IN A SOLUTION** (or cooling from molten rock) is like a **HIGHLY ACTIVE CONSTRUCTION SITE**. Strong physical **FORCES OF ATTRACTION** are drawing the unit cells together. The unit cells are constantly collecting on all parts of the growing crystal, staying for a bit, and then zooming away again. This happens mostly on the edges and corners, and a little less on the flat surfaces. Usually, the arriving unit cell doesn't fit well into its **LANDING SITE**, so it quickly flits off. Sometimes, though, the right unit cell joins just the right place on a growing **CRYSTAL STRUCTURE**, or **LATTICE**, and it is held tight there. That is how a crystal grows, layer by layer.



**"Volcanoes are geode factories"**

















# SHAPE UP, CRYSTALS!

The chemical makeup of the unit cell of a crystal affects the shape in which the crystal forms. There are **SEVEN BASIC CRYSTAL SHAPES**, called **CRYSTAL SYSTEMS**, each characterized by its **UNIQUE GEOMETRIC ARRANGEMENT OF CRYSTAL FACES**.

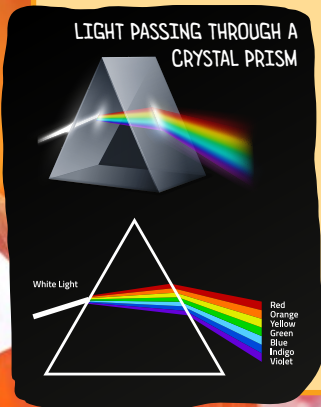


**“Glow-in-the-dark geodes”**

## Crystal Systems

Name	Description	Diagram	Example
Cubic (Isometric)	Symmetrical shapes with equal sides and angles, like cubes or dice.		Pyrite 
Tetragonal	Crystals with a four-sided prism shape, where two sides are longer or shorter than the other two.		 Zircon
Hexagonal	Crystals with a six-sided prism shape, often resembling a pencil or column.		Apatite 
Trigonal (Rhombohedral)	Crystals with a three-sided prism shape, similar to hexagonal crystals but with different angles.		 Quartz
Orthorhombic	Rectangular-shaped crystals with three unequal axes at right angles to each other.		Topaz 
Monoclinic	Crystals with three unequal axes, but only two are at right angles to each other.		 Selenite
Triclinic	Crystals with three unequal axes, none of which are at right angles to each other.		Amazonite 

# WHY ARE CRYSTALS SO SPARKLY?



Crystals **SPARKLE** and create **RAINBOWS** because of how **LIGHT PASSES THROUGH THEM**. The regular, repeating arrangement of unit cells causes **LIGHT WAVES** to be **REFRACTED** — or change direction — as they pass through the crystal. The refracted light bouncing off of surfaces inside the crystal is what causes it to sparkle.

Similar to the sparkle effect, rainbows in crystals are caused by the **DISPERSION** of light. When light enters a crystal, it may be separated into its component colors (like a rainbow) due to the crystal's ability to **REFRACT DIFFERENT COLORS OF LIGHT BY DIFFERENT AMOUNTS**. The dispersion of light can create beautiful rainbow-like patterns within or around the crystal, especially when the crystal has flat, reflective surfaces for the light to bounce off of.

## GEODE FIELD NOTES

Describe each of **your geodes** below. You can record things like the geode's size, shape, color, the number of pieces it broke into, and the appearance of the crystals inside.



**WOW FACT**



**"A rocky bubble bath"**

1	6
2	7
3	8
4	9
5	10

# GEODES OF THE WORLD

**WOW FACT** #8  
“From rocks to riches”



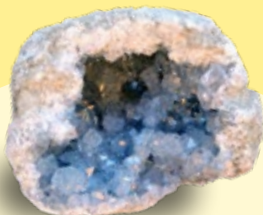
**QUARTZ GEODES:** Filled with various forms of quartz crystals, these geodes often have an outer layer of **CHALCEDONY**, which is a form of silica with extremely fine crystals resulting in a dull, waxy appearance.



**AMETHYST GEODES:** Filled with purple amethyst crystals, a purple variety of quartz, these geodes are prized for their beautiful, rich coloration.



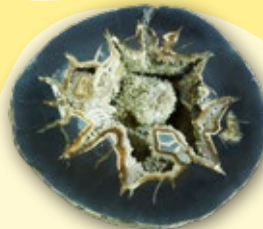
**CALCITE GEODES:** Filled with calcite crystals, these geodes may exhibit a range of colors, including white, orange, yellow, or pink.



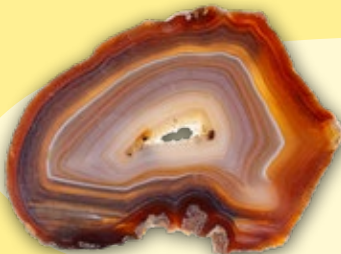
**CELESTITE GEODES:** Containing crystals of celestite, these geodes display delicate blue hues.



**JASPER GEODES:** Filled with jasper, a type of chalcedony, these geodes can exhibit a range of warm, earthy colors and patterns. Fun fact: Geodes that are completely solid inside, like this one, are called **THUNDEREGGS**.



**SEPTARIAN GEODES:** Composed of a combination of minerals, including calcite, aragonite, and barite, septarian geodes often display distinctive patterns of cracks filled with different minerals.



**AGATE GEODES:** Agate is a rock consisting primarily of alternating layers of chalcedony and crystalline quartz. These geodes can have a variety of colors, patterns, and degrees of transparency within their banded layers.

**DRUZY GEODES:** This refers to all geodes with a layer of very tiny crystals on the inner surface, which can look something like sparkly velvet. It can occur with different minerals.

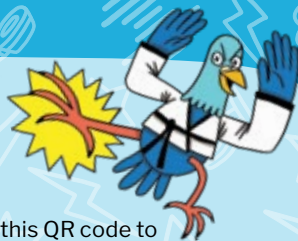
# NEXT-LEVEL CHALLENGES

Try these experiments on your own!

1. Start a rock collection and put the specimens you find in the display case.
2. Make your own geodes by forming a bowl of modeling clay and growing alum crystals inside.
3. Use jewelry wire wrapped around a geode fragment to make a geode ring you can wear.



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