



ITEM #2896
AGES 10 AND UP

WARNING:

THIS KIT CONTAINS CHEMICALS THAT MAY BE HARMFUL IF MISUSED. READ ALL WARNING STATEMENTS ON INDIVIDUAL PACKETS AND INSTRUCTIONS BEFORE USING THIS KIT.

THIS CRYSTAL KIT MAY BE USED BY YOUNG CHILDREN ONLY WITH ADULT SUPERVISION.

IF DRY POWDER OR MIXED LIQUID IS SPILLED, RINSE WITH WATER. DO NOT USE ANY BLEACHES OR CLEANERS CONTAINING CHLORINE.

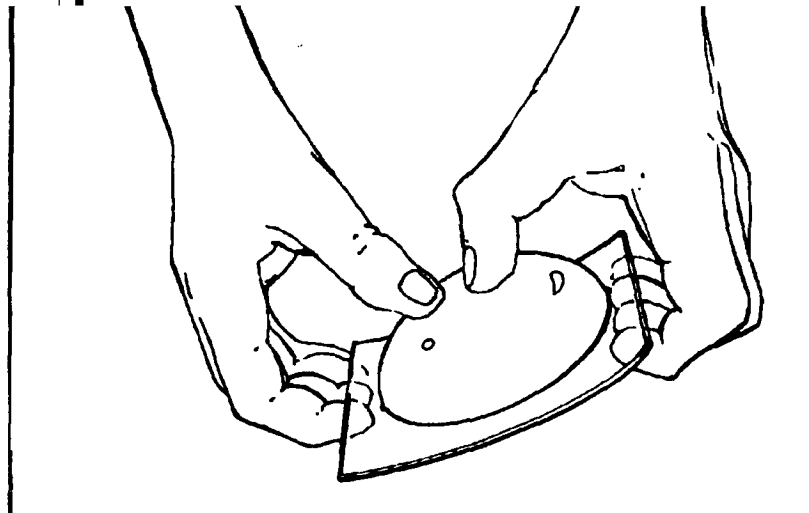
WARNING:

"Only for use by children over 10 years old. To be used solely under the strict supervision of adults that have studied the precautions given in the experimental set."

SMITHSONIAN®

CRYSTAL GROWING SET - SERIES I

CRYSTAL GROWING PROCEDURES



"FROSTY DIAMOND" CRYSTAL CLUSTER
and
"PURPLE AMETHYST GEODE"
and
"DIAMOND SINGLE CRYSTALS"



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CRYSTALS AND CRYSTAL GROWING PROCEDURES

WARNING! READ ALL SAFETY PRECAUTIONS BEFORE STARTING. ALL CHEMICALS AND PROCEDURES HAVE THE POTENTIAL TO CAUSE HARM!

In this crystal growing set, the chemicals used and the procedures outlined have been made as safe as possible through careful testing and packaging. However, they are not without some hazard since ALL chemicals ARE potentially dangerous. Be sure you read the warnings and caution statements on the individual containers and follow the procedures and directions carefully.

NOTE: This crystal growing kit may be used by young children only with adult supervision!

(1) NEVER put any chemicals, crystals or solutions into the mouth. Never swallow or eat any chemicals, crystals or solutions. Do not eat or drink when handling chemicals, crystals or solutions.

(2) AVOID contact of any chemicals, solutions or crystals with the skin, eyes and mouth. Be careful of stirring sticks and containers which have been used with the chemicals or solutions. Always wash your hands and arms after handling chemicals, crystals, or solutions. Keep your work area clean and dust-free!

(3) READ INSTRUCTIONS for each procedure before actually doing the procedure. Make sure you have all of the equipment and materials ready for the procedure before starting.

(4) If chemicals accidentally come in contact with skin, wash the area with soap and water. If eye contact occurs, carefully flush eyes with water for 15 minutes. If irritation occurs, or if it persists, get medical attention. Some chemicals may form or contain DUST. If a chemical dust is inhaled, seek fresh air. If symptoms occur, seek medical attention. If any chemicals, crystals or solutions are swallowed, immediately rinse your mouth with milk or water; drink several glasses of milk or water. Seek medical attention or call a Poison Control Center.

(5) Keep chemicals, solutions and crystals out of the reach of small children and pets.

(6) Always work with the safety goggles, which are supplied in your crystal growing kit.

(7) Make sure your work area is covered with several sheets of newspaper or a waterproof plastic sheeting to reduce the problem of spills from chemicals and from the dyes which are used in the chemical solutions. If there is a spill, clean the area immediately with paper towels.

(8) It is important to cover clothing with a protective layer of cloth, plastic or rubber. You should obtain an apron (like a workshop apron) and wear it while you are doing the procedures.

(9) Dispose of USED chemicals in a manner which is environmentally safe. Talk to your parents or school science teacher about the best way to dispose of chemicals.

NO MATTER WHAT THE EXPERIMENT, EQUIPMENT OR PROCEDURE, THE ONE THING TO CONSIDER AT ALL TIMES IS S-A-F-E-T-Y

ALWAYS WEAR YOUR SAFETY GOGGLES WHEN PERFORMING EXPERIMENTS WITH CHEMICALS OR DOING THE PROCEDURES OUTLINED FOR CRYSTAL GROWING AND SOLUTION MAKING! BE CAREFUL WHEN HANDLING HOT WATER! ALWAYS WEAR YOUR SAFETY GOGGLES WHEN BREAKING UP ROCKS FOR THE "BASE ROCKS" FOR YOUR CRYSTALS.

CONTENTS OF YOUR CRYSTAL GROWING KIT

Your crystal growing kit contains the following materials and equipment for growing beautiful chemical crystals:

- Safety goggles
- One size "A" plastic crystal growing cup
- One size "B" plastic crystal growing cup
- One size "C" plastic crystal growing cup
- Two size "E" plastic crystal growing cups
- One plastic geode mold
- 2 poly bags of crystal growing chemicals
- 1 poly bag of geode shell plaster
- 2 wooden spatulas
- 12" of monofilament plastic thread
- Instruction booklet
- Graduated measuring cup marked in "ml" (milliliters), "cc" (cubic centimeters), as well as in "oz" (ounces)
- Magnifying glass
- Poly bag containing granite "base rocks"

MATERIAL NEEDED TO BE SUPPLIED BY YOU

Gather together the following materials and containers to help your procedures run more smoothly and to insure that your crystal growing will be more successful.

You will need:

- A room or location in your home where the temperature remains relatively constant and where the crystals may grow and not be disturbed. Once you place your crystals ready to grow, try not to disturb them.
- A medium size saucepan in which to heat water to boiling. Always use a stainless steel or Teflon® coated saucepan. Never use an aluminum saucepan! The boiling water will be used to dissolve chemicals. When using boiling water, always have parents or an adult help you.
- Plenty of newspaper or plastic sheeting to protect your work area from spills and from the dyes which are added to many of the chemicals. The powerful dyes may stain floors or table tops if the colored solutions are spilled onto these surfaces.
- Several small clean used jars with tops (like used jelly jars, baby food jars or canning jars) in which to store some of your chemical solutions for use later on.
- A small plastic bucket (like a clean used peanut butter bucket or discarded quart Tupperware® container). Make sure that your containers and buckets are thoroughly cleaned and dried.
- A supply of paper towels or tissue paper for drying crystals and cleaning up any spills.
- Flashlight
- Several long pencils
- Two-part glue or model maker's white glue
- Scissors

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NOTE: The measuring cup included with this kit is marked with ounces (oz.) and cubic centimeters(cc.). One milliliter equals one cubic centimeter.
For Example : 1ml = 1cc
2ml = 2cc
3ml = 3cc

- A selection of various rocks on which you will grow your own crystals. These rocks may be collected from the neighborhood or may be from your own rock collection. The prettier and more interesting the rocks you use, the more interesting will be the "bases" for your crystals to grow on. You may have to break the rocks with a hammer. When breaking rocks with a hammer, work outdoors, and **always wear your safety goggles**. Cover the rock you are trying to break with an old cloth or burlap sack to prevent rock shards from shattering or flying outward from the breaking area. Be careful of sharp edges from the broken rocks. You may also use the granite "base rocks" supplied in your kit.
- Transparent tape on which you can write with a permanent ink marker. This will help you keep track of which chemical solutions you are saving and which crystals are growing in each container.

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GETTING READY

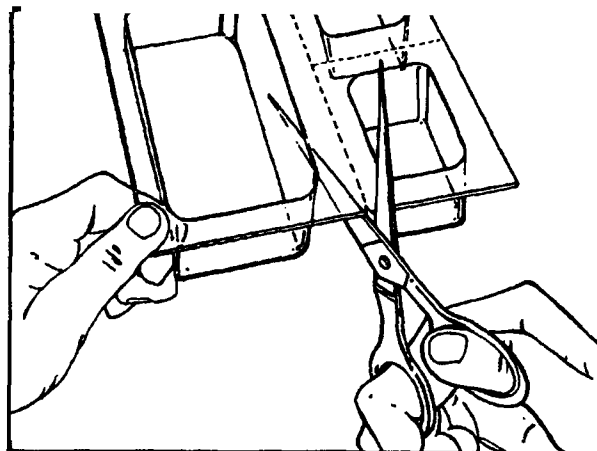
Using scissors, cut apart the individual plastic crystal growing cups from the plastic sheet where they are all attached. Leave a rim around each individual plastic growing cup, but cut off sharp points from the corners of the rims.

KEEPING RECORDS - LABORATORY NOTES:

It is important to keep a record of each procedure you perform. Use a small notebook and pencil to record the important information about each operation OR you may use the record keeping log at the end of each procedure.

The information you should record is:

1. Time and date you start each crystal growing procedure.
2. Time and date you end each crystal growing procedure.
3. What size rock and what type rock used for the "base rock" for your crystal growing procedure.
4. The name of the chemical used, how much chemical used, and how much water used in each crystal growing procedure.
5. Record the room temperature and the solution temperature at the beginning of each crystal growing procedure.
6. Comments: Note also when you could first see crystals beginning to grow, what shape they are, and how fast they appear to grow. Note if the "base rocks" you are using are light or dark colored and what kind of rock is used for "base rocks" (like limestone, granite, etc.). You may wish to use the "record keeping log" printed at the end of each procedure. The most important technique to develop is to measure all chemicals and all amounts of water **VERY CAREFULLY**. For each crystal growing experiment, the amount of water needed is given in grams and milliliters (ml) as well as in cups, teaspoons and tablespoons. You may use any system you like, but the metric measurement in milliliters (ml) or grams (g) will be used in this manual.
7. When you remove the crystals from their growing vessel and are making ready to dry them, place the crystals on absorbent paper toweling or newspaper and let them dry for a day or so undisturbed. Letting the crystals dry this way will insure the crystals become firmly attached to the "base rocks" and will serve as a safe and stable method to display your new crystals.
8. If you make a display of all your crystals, it is important to keep them dry and free of dust, and away from too much heat. Some of the crystals you grow are very delicate and will break if handled roughly. If you can find some clear plastic boxes in which to display them, all the better. If your crystals get dusty, you may want to clean them off with a soft bristle brush, or the air from a hair dryer.



Carefully cut all of the crystal growing cups apart from one another. Be sure to leave a rim around each growing cup. Also remove any sharp corners from the rims with your scissors.

Crystals which are found in nature may have taken thousands or even millions of years to grow into the final shape and size which we recognize. Some natural crystals form in hot solutions of chemicals deep within the earth. Crystals may also form as the result of minerals from molten rock or superheated vapors of minerals or elements.

The crystals which you will grow in this kit are chemical crystals. Your crystals grow very rapidly, needing only a few hours or days to complete their growth. Both the crystals found in nature and the ones you grow from your kit are actual crystals with internal structures much the same, except you do not have to wait thousands of years to see the result of your crystal growth!

REMEMBER: All of your crystals will re-dissolve in water!! So do NOT get your crystals wet or try to wash them . . . the crystals will turn back into solution!!

"Frosty Diamond" Crystals

The "Frosty Diamond" crystals in Procedure #3 belong to the same crystal system as natural diamond (cubic), which consists of pure carbon. Natural diamond is the hardest material known to man. Graphite (pencil "lead") is also made of carbon, but it is very soft. That is why your pencil leaves a mark on paper. Why is diamond so much harder than graphite when both crystals are made of the same atoms? The explanation must lie in the way the atoms are arranged. In diamond, the attraction between atoms (called a chemical bond) is very strong in all directions. The carbon atoms in graphite, however, are arranged in layers that are only weakly attracted to one another. This is why graphite is so soft. When you scratch graphite with your fingernail, you are literally breaking the chemical bonds that hold the layers together! The "Frosty Diamond" crystals you will grow in a water (aqueous) solution of aluminum potassium sulfate are not real DIAMONDS, of course, but large attractive chemical crystals.

PROCEDURE #3: "FROSTY DIAMOND" CRYSTAL CLUSTER

OVERVIEW - PROCEDURE #3:

In procedure #3- "Frosty Diamond" Crystal Cluster, you will grow crystal clusters of a clear to frosty appearance on a base rock. The crystal growing chemical contains Aluminum Potassium Sulfate and no colorant. After you have grown the "Frosty Diamond" crystal cluster, keep them as clean and dry as possible. If they become dusty, they may be cleaned with a soft brush or with air from a gentle blower such as a hair dryer. Protect your finished crystals from harsh light and moisture.

You will need the following materials to complete this procedure:

- Safety goggles
- Polybag #3 containing "Frosty Diamond" crystal growing chemical
- Plastic bucket (like an empty peanut butter plastic pail - washed out, clean and dried - OR a quart sized Tupperware® container, clean and dry)
- Measuring beaker - supplied with your crystal growing kit
- Size "A" plastic crystal growing cup
- Two size "E" plastic crystal growing cups
- Wooden spatula (for stirring)
- Sauce pan for boiling water. Use only stainless steel or Teflon® coated saucepans. Do NOT use aluminum saucepans! (Let your parents help you with boiling water) OR styrofoam cup if water is boiled in micro-wave
- "Base Rock" pieces to place in bottom of crystal growing cup for your crystals to grow upon. (A dark rock is best to use for this crystal)
- Quart size jar with tight fitting lid for storing excess crystal growing solution for later procedures
- Newspaper or plastic sheeting to cover your working area to reduce the hazard of spills on table or floor
- Flashlight
- Magnifying glass
- Small notebook and pencil for recording the steps of your procedure, or you may use the record log at the end of this procedure.

Procedure steps:

- (1) Open poly bag #3, the "Frosty Diamond" crystal growing chemical, and pour the contents into the clean, dry, plastic bucket or quart Tupperware® container.
- (2) Using your graduated measuring beaker, measure out 1 3/4 ounces (oz) or about 50 ml of the chemical crystals.
- (3) Put this 1 3/4 oz. (or 50 ml) BACK into poly bag #3 for later use in the geode procedure.
- (4) Again using your graduated measuring cup, measure out about 680 milliliters (ml) of water and pour this water into the saucepan. You will have to use your graduated beaker multiple times to get up to 680 ml. (Four fillings of 140 ml each, and one filling of 120 ml, will total the 680 ml of water you require). Place the saucepan on the stove and heat the water to boiling.
- (5) Carefully add the 680 ml of boiling water to the chemical in the Tupperware® container or plastic (peanut butter) bucket. Stir the mixture with your wooden spatula until all of the chemical grains have dissolved.
- (6) Now prepare your "base rock" for this crystal growing procedure, by selecting a dark colored, flat, "base rock" which will nearly cover the bottom of a size "A" crystal growing cup.

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You will grow "Frosty Diamond" crystal clusters from the materials in your crystal growing set. These are not real diamonds, of course, but are still beautiful, large crystals formed from the chemical Alum (Aluminum Potassium Sulfate).

You may have to use a hammer and chisel to break and trim the rock to size. If so, be sure and wear your safety goggles while doing so. You may wish to place several small rocks, instead of one large one, to cover the bottom of the growing cup. Try to cover the bottom of the growing cup as completely as possible but make sure the rocks do not come up more than 1 1/2" (4 cm) from the bottom of the cup.

(7) Pour the chemical/water solution on the top of the rocks in the size "A" plastic crystal growing cup. The solution should fill the growing cup right up to the rim.

(8) Store the remaining solution in a storage jar with a tight fitting lid for use later on.

(9) Allow the crystals to grow on their own for several days and until the crystals start to grow toward the surface of the liquid in the growing cup. Since some of the solution will have evaporated, add more solution from the storage jar of excess solution to replenish the solution in the growing cup.

(10) Add more solution to the growing cup every few days until your "Frosty Diamond" crystals have grown to the height of the growing cup.

(11) When you are satisfied that you have crystals as large as you desire, remove the "base rocks" with the crystal growth on them and set aside on paper toweling or newspaper to become completely dry.

(12) The crystals which may have grown on the sides or bottom of the plastic crystal growing cup may now also be removed and placed on paper toweling or newspaper to become dry. After they are completely dry, return these crystals to the "Frosty Diamond" poly bag #3. Save them for re-use in a later procedure.

(13) Pour the extra solution from the plastic growing cup into your storage jar. Label the jar with transparent tape as to which solution the jar contains. Retain this jar of solution in a quiet place and let it remain undisturbed for three days.

(14) After the solution in the storage jar has "cleared", pour the clear top portion of the solution into two small size "E" plastic growing cups. Keep the remainder of the solution in your storage jar for use in procedure #10.

(15) After a few days, single crystals will form in the two size "E" growing cups. Let these "seed crystals" grow undisturbed until they reach a size of 1/6" (4 mm). When they are large enough, allow them to dry and save these "seed crystals" for use in procedure #10.

(16) Now clean out all of the growing cups and spatulas you have used in this procedure and dry them for later use.

RECORD KEEPING LOG: Procedure #3: "FROSTY DIAMOND" CRYSTAL CLUSTER

(1) Date this procedure started: _____ Time started: _____

(2) Type of "base rock" used (limestone, granite, etc.): _____

(3) Number of "base rocks" used: _____ Total weight of "base rocks": _____ g.

(4) Name of Chemical used: _____ Polybag No.: _____

(5) Weight of Chemical used: _____ g.

(6) Amount of Water used: _____ ml.

(7) Room temperature of crystal growing room: _____ °C.

(8) Temperature of solution at beginning of procedure: _____ °C.

(9) Temperature of solution at end of procedure: _____ °C.

(10) Temperature of room at end of procedure: _____ °C.

(11) Date when first crystal growth observed: _____ Time: _____

(12) Estimated size of first crystals seen growing: _____

(13) Estimated growth rate of crystals seen growing: _____

(14) Date procedure ended: _____ Time: _____

(15) Amount of dry crystal residue saved after procedure: _____ g.

(16) Amount of residue solution saved after procedure: _____ ml.

(17) Amount of dry "seed crystals" obtained: _____ g.

"Purple Amethyst Geode"

Actual AMETHYST is a variety of quartz crystal which is tinted purple by the presence of small amounts of ferric iron present as the quartz crystal forms. Actual amethysts are often found in geodes.

The "Purple Amethyst Geode" in Procedure #5 will look very similar to a real geode that has been broken into two pieces. However, there are important differences. Geodes in nature are formed inside spherical cavities or holes in rocks. At first, they consist of a soft, jelly-like outer shell. This jelly-like shell is made of a rich mixture of minerals, sand and dissolved chemicals. After the outside of the geode has hardened due to heat and pressure it begins to crack, and chemical solutions enter the cavity. Crystals grow from these solutions by attaching their base to the walls of the cavity. Sometimes the crystals grow so large that the entire cavity is filled. More often, though, the center part of the geode is empty. The outer shell of the geode is made of chert, which is a very hard and resistant silica mineral. This is why geodes do not break apart easily, and must be cut with a special blade coated with diamond crystals. Once the geode has formed, the surrounding rock may be completely worn away but the geode is not destroyed because of its hard outer shell. If you find a geode lying on the ground, remember that it was once a small cavity inside a rock that has long since disappeared! A variety of minerals are found in geodes but the most common is quartz. Amethyst is a type of quartz that is purple in color.

Your chemically grown geode is made of the chemical aluminum potassium sulfate (alum) which is embedded in a plaster (calcium sulfate) shell. A water (aqueous) solution of alum and purple dye is then poured over the plaster "geode shell". The amethyst "look-alike" crystals then begin to form on the surface of the plaster geode shell. Your "amethyst" crystals will form in the hexagonal crystal system, similar to actual amethyst crystals.

PROCEDURE #5: "PURPLE AMETHYST GEODE"

OVERVIEW - PROCEDURE #5:

In procedure #5 - "Purple Amethyst Geode", you will form a plaster geode in the geode mold. The plaster half-egg casting will contain the Plaster of Paris (calcium sulfate) and seed crystals upon which your geode crystals will grow. The crystal growing solution will contain aluminum potassium sulfate and a concentrated food dye colorant. Your finished "Purple Amethyst Geode" will have crystals growing on all surfaces of the geode shell. After you have grown the "Purple Amethyst Geode" keep it as clean and dry as possible. If it becomes dusty, it may be cleaned with a soft brush or air from a gentle blower such as a hair dryer. Protect your finished geode from harsh light and moisture.

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You will need the following materials to complete this procedure:

- Safety goggles
- Polybag #5 containing "Purple Amethyst Geode" growing chemical
- Plastic bucket (like an empty peanut butter plastic pail, washed out clean and dried), OR a quart sized Tupperware® container, clean and dry
- 50 ml. (or 1 3/4 oz.) of "Frosty Diamond" crystal growing chemical saved from Procedure #3, step #3.
- Poly bag #9 containing Plaster of Paris "Geode Shell Material"
- Plastic geode mold (half-egg shaped mold)
- Size "B" plastic crystal growing cup
- Size "C" plastic crystal growing cup
- Plastic graduated beaker (for measuring liquid & solid amounts)
- Wooden spatula (for stirring)
- Sauce pan for boiling water (let your parents or another adult help you with boiling water) OR styrofoam cup if water is boiled in microwave
- "Base rock" pieces to place in the bottom of plastic crystal growing cup for your crystals to grow upon and to support the geode shell
- Small storage jar with lid for storing the excess solution for a later procedure
- Newspaper or plastic sheeting to cover your working area to reduce the hazard of spills on table or floor
- Flashlight
- Magnifying glass
- Small notebook and pencil for recording the steps of procedure or you may use the record log at the end of this procedure

Procedure steps:

In this procedure you will not only "form" the geode shells (1/2 egg-shaped plaster castings), but you will grow colored crystals in and on the "geode casts" to produce a geode-like crystal specimen. Purple crystals will also be grown on some base rocks placed in the bottom of the size "B" plastic crystal growing cup. These "base rocks" will support the geode casting.

- (1) Open poly bag #9 labeled "Geode Shell Material" (Plaster of Paris).
- (2) Pour this "Geode Shell Material" on to a large clean piece of paper.
- (3) From your "Frosty Diamond" poly bag #3, measure out 50 ml (about 50 g) of the crystals you saved back from that procedure.
- (4) Add these 50 ml of "Frosty Diamond" crystals to the Plaster of Paris on the sheet of paper. Mix these two dry chemicals together. **Mix them thoroughly.**

(5) Now divide the plaster and chemical mixture into two equal halves, using your wooden spatula as a divider tool.

(6) Return one (half) mixture back to the geode shell poly bag for later use.

(7) Pour the other (half) mixture into your geode shell mold. Support the round geode mold while you are working by placing it temporarily into the top of a size "C" plastic growing cup. This will give you a firm support for the geode mold while you mix and spread the plaster/chemical mixture in the round-bottomed geode mold.

(8) Using your measuring beaker, add 13 ml of water to the plaster/chemical mixture in your geode mold.

(9) Working quickly, mix the water and chemicals together to form a paste, and spread this paste evenly, using your wooden spatula to coat the sides and bottom of the geode mold with the paste, leaving a concave depression in the center of the geode. This paste will start to harden fairly rapidly. When you feel like the plaster mixture/paste is hardening, be sure you have completed all of the spreading and molding you are going to do.

(10) Using a clean wooden spatula as a scraper, scrape off the top of your geode mold so that your hardening geode casting is even with the rim of the geode mold.

(11) Let the geode shell casting harden for about 30 minutes. Turn the plastic geode mold cup upside down and press the bottom firmly with your thumbs in order to press the new plaster casting out of its mold.

(12) Now repeat steps 7, 8, 9, 10 and 11 so that you end up with two plaster geode shells.

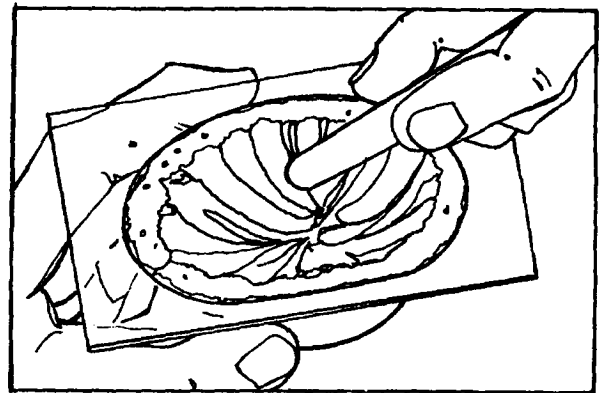
(13) Place the two plaster casting geode shells into a size "B" crystal growing cup with the concave (open) side facing upward. If you wish, you may place one or two "base rocks" beside the geode casting shells. The "base rocks" which you add should only be about an inch (2.5 cm) thick. These will serve to hold the castings in place as well as to promote crystal growth on the "base rocks" themselves.

(14) Open poly bag #5, "Purple Amethyst Geode" and pour the contents into your clean plastic bucket (peanut butter bucket, cleaned and dried) or quart Tupperware® container.

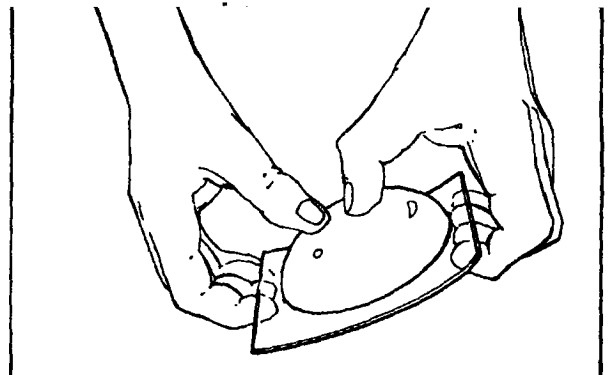
(15) Using your graduated beaker, measure out 380 ml of water into a small saucepan. You will have to use the graduated beaker multiple times to measure out the full 380 ml (two full measures of 140 ml each, and one partial measure of 100 ml). Boil this 380 ml of water in the saucepan on the stove.

(16) Pour the boiling 380 ml of water over the chemicals in the plastic bucket. (You may wish to have your parents or an adult help you with pouring the boiling water). Using your wooden spatula, stir the chemical/hot water mixture until all of the chemical grains have dissolved.

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Using your wooden spatula, coat the sides and bottom of the geode mold evenly with the plaster in order to form a concave shell of plaster. Allow plaster to dry for 30 minutes before removing plaster geode shell from the mold.



After the plaster dries, carefully remove the finished "geode shell"

(17) Cool the chemical/water mixture for about five minutes.

(18) Finally, pour the chemical/water solution over the geode castings in the size "B" crystal growing cup. The solution should cover all of the surfaces of the geode casting and will fill up the size "B" container nearly to the rim.

(19) Allow the crystals to grow for at least a week, or until crystal growth can be observed reaching the surface of the solution.

(20) When you are satisfied that you have crystal growth as large as you can get, remove the geode casting with the crystal growth on it, and place on a piece of newspaper or paper toweling to dry for at least one day.

(21) Pour the remaining solution into your save jar and label it as to which solution it is. Save this solution for use in follow-up experiments.

(22) Remove the remaining crystals which grew on the sides or bottom of the growing cup, dry them on newspaper or paper toweling, and keep for use later on.

(23) Clean thoroughly and dry the crystal growing cup and other containers you have used during this procedure.

(24) If you desire more growth of crystals on your geode shells, you may try the following: Using a stainless steel saucepan or a Teflon® coated saucepan (do not use an aluminum pan), combine the excess solution saved in step #21 and the "excess" crystals from step #22. Add about 60 milliliters (ml) of water to this mixture. Now, heat this mixture to near boiling. Stir the mixture with your wooden spatula until all of the solid material and crystals have dissolved. ALLOW TO COOL FOR ABOUT 5 MINUTES.

(25) Reposition your geode shells back into the clean size "B" growing cup, and pour the new solution back over the geode shells. Allow the crystals to grow as before on your geode shells.

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RECORD KEEPING LOG: Procedure #5: "PURPLE AMETHYST GEODE"

(1) Date this procedure started: _____ Time started: _____

(2) Type of "base rock" used (limestone, granite, etc.): _____

(3) Number of "base rocks" used: _____ Total weight of "base rocks": _____ g.

(4) Name of Chemical used: _____ Polybag No.: _____

(5) Weight of Chemical used: _____ g.

(6) Amount of Water used: _____ ml.

(7) Room temperature of crystal growing room: _____ °C.

(8) Temperature of solution at beginning of procedure: _____ °C.

(9) Temperature of solution at end of procedure: _____ °C.

(10) Temperature of room at end of procedure: _____ °C.

(11) Date when first crystal growth observed: _____ Time: _____

(12) Estimated size of first crystals seen growing: _____

(13) Estimated growth rate of crystals seen growing: _____

(14) Date procedure ended: _____ Time: _____

(15) Amount of dry crystal residue saved after procedure: _____ g.

(16) Amount of residue solution saved after procedure: _____ ml.

"Diamond" Single Crystals

Have you ever wondered what the Earth is like hundreds of kilometers (1 kilometer = 0.62 mile) below the surface? The occurrence of natural diamonds in certain types of rocks provides a clue. Diamond crystals are mined in South Africa from a rock called kimberlite. These rocks are now at the surface, but the presence of diamond crystals indicates that at one time, millions of years ago, they were deep beneath the surface where the temperature and pressure are high enough to change carbon into diamond. When we examine kimberlite, we are looking at rock that came from deep inside the Earth! Actual diamonds are found in single crystals in a granular rock called peridotite. The variety of peridotite containing diamonds is called kimberlite.

The single large chemical crystals which you will grow in Procedure #10 are, of course, not real diamonds. Your crystals are made of the chemical aluminum potassium sulfate and are grown from seed crystals of the same chemical. The procedure, as outlined below, is different from growing crystal clusters since single large crystals grown on monofilament thread are allowed to grow on all of their faces at the same time. The result is a large perfectly formed crystal undisturbed by the growth of neighboring crystals.

PROCEDURE #10: SINGLE LARGE CRYSTALS ("CLEAR DIAMOND")

OVERVIEW - PROCEDURE #10:

In procedure #10 - Single Large Crystals ("Clear Diamond"), you will be growing four crystals on monofilament thread. Seed crystals from procedure #3 will be glued onto the monofilament thread. These seed crystals will be suspended in a crystal growing solution containing aluminum potassium sulfate. After several weeks of growth, the crystals may be removed from the growing solution and used as single example specimens, or glued to an attractive base rock. Protect your crystals from moisture and dust. If they become dusty, they may be cleaned with a soft brush.

You will need the following materials to complete this procedure:

- Safety goggles
- Polybag #3 containing excess crystals from procedure #3 ("Frosty Diamond")
- Size "C" plastic crystal growing cup
- Monofilament plastic thread (included in your set)
- Long wooden pencil
- Transparent cellulose tape
- Solution saved from procedure #3 ("Frosty Diamond")
- Scissors
- White glue OR two-part epoxy glue
- Newspaper or plastic sheeting to cover your work area to reduce the hazard of spills on table or floor
- Flashlight
- Magnifying glass
- Small notebook and pencil for recording the steps of your procedure, or you may use the record keeping log at the end of this procedure

Procedure steps:

(1) Open poly bag #3 containing the crystals you saved from the "Frosty Diamond" procedure #3. Pour contents out on a clean sheet of paper for examination. Examine the crystals with a magnifying glass. Select the crystals which are the largest and are the best formed crystals.

(2) Select four of the best and most well-formed crystals. If there are notable deformities to these crystals, it is due to their growth on a flat surface. In this procedure you will grow crystals on a monofilament thread, which will allow the crystals to now grow to a large and more perfect shape.

(3) Cut your monofilament line with scissors to lengths of 4" (10 cm). You will need four lengths of a 4" (10 cm) long line.

(4) On a clean piece of paper, put a dab of white glue (or two-part glue if desired). Dip one end of the monofilament line into the dab of glue, and then touch the glued end to one of your selected "seed crystals". Glue each of the selected "seed crystals" to one end of a piece of the monofilament line. Set these aside to let the glue dry completely.

ALWAYS WEAR YOUR SAFETY GOGGLES WHEN PERFORMING EXPERIMENTS WITH CHEMICALS OR DOING THE PROCEDURES OUTLINED FOR CRYSTAL GROWING AND SOLUTION MAKING! BE CAREFUL WHEN HANDLING HOT WATER! ALWAYS WEAR YOUR SAFETY GOGGLES WHEN BREAKING UP ROCKS FOR THE "BASE ROCKS" FOR YOUR CRYSTALS.

(5) When the monofilament line has been glued securely to the crystals, either tie or tape the monofilament lines to a long wooden pencil. Each line should be distanced from its neighbor by about 3/4" (2 cm). Neither the lines nor the crystals should touch the sides or bottom of the growing cup. The crystals should be arranged so that they are suspended in the center of the size "C" growing cup halfway between the bottom and the top rim. The pencil will act as a support across the top of the growing vessel, upon which the lines and their crystals are suspended.

(6) After you have arranged the monofilament line and the crystals on the pencil to your satisfaction, tape the monofilament lines so that they do not slip on the pencil. Remove the set-up from the size "C" growing cup and put it aside momentarily.

(7) Fill the size "C" crystal growing vessel with the solution from the save jar from procedure #3 ("Frosty Diamond" solution). Let this size "C" crystal growing cup with the solution in it stand quietly for three days, or until small crystals begin to grow on the bottom of the growing cup.

(8) Take your pencil with its attached seed crystals and dip the crystals briefly in luke warm water. Now hang the crystals in the size "C" growing cup filled with the solution. Again, make sure the seed crystals do not touch each other or the sides or bottom of the cup.

(9) Keep this crystal growing apparatus and the solution in a room or location where the temperature stays fairly constant and is undisturbed. As the solution starts to evaporate into the air, the crystals will begin to grow.

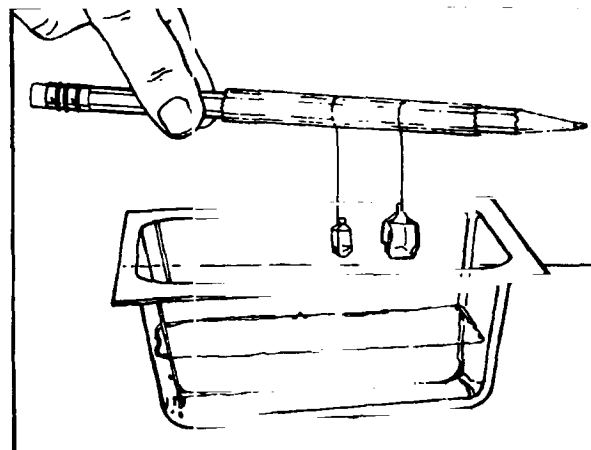
(10) You may add more solution from time to time to the crystal growing container, each time you observe the growth of the crystals. This procedure may take as long as three weeks, or until such time as you are satisfied with the size of your crystals.

(11) When the crystals have grown as large as you can get them, remove them from the solution, dry them on paper toweling or newspaper, and cut the monofilament threads off close to the crystals.

(12) You may display these crystals as examples of single large crystals, or you may wish to glue them on to base rocks for individual displaying.

(13) Pour the excess solution back into the save jar.

(14) Clean your size "C" growing cup for later use.



Seed crystals, already glued onto the monofilament thread, are ready to be suspended in the solution in a size "C" growing cup.

The monofilament thread is tied loosely around a pencil, and when the length of the line and the spacing of the seed crystals is just right on the pencil, a small length of tape will secure the thread to the pencil.

RECORD KEEPING LOG: Procedure #10: SINGLE LARGE CRYSTALS "CLEAR DIAMOND"

(1) Date this procedure started: _____ Time started: _____

(2) Type of "base rock" used (limestone, granite, etc.): _____

(3) Number of "base rocks" used: _____ Total weight of "base rocks": _____ g.

(4) Name of Chemical used: _____ Polybag No.: _____

(5) Size of seed crystals selected: _____ mm

(6) Number of seed crystals selected: _____

(7) Room temperature of crystal growing room: _____ °C.

(8) Temperature of solution at beginning of procedure: _____ °C.

(9) Temperature of solution at end of procedure: _____ °C.

(10) Temperature of room at end of procedure: _____ °C.

(11) Date when first crystal growth observed: _____ Time: _____

(12) Estimated size of first crystals seen growing: _____

(13) Estimated growth rate of crystals seen growing: _____

(14) Date procedure ended: _____ Time: _____

(15) Size of finished crystals: _____ mm

(16) Weight of finished crystals: _____ g

FOLLOW-UP EXPERIMENTS

After completing all of the procedures, you should now have a collection of various crystal specimens of different crystalline shapes and colors.

You will also have an assortment of "saved" residue chemical solutions and residue crystals. You may experiment with these to try and grow your own crystals. You may experiment with growing large single crystals or with growing clusters of crystals. You may also want to try to grow multi-colored crystals by first growing a crystal cluster of one color and then changing the solutions to have the final growth of those crystals of a different color.

For example: if you use the chemicals from the "Purple Amethyst" crystal procedure as well as chemicals from other procedures, what kind of results can you obtain?

You have seen that by evaporating solutions you can concentrate the growing solutions to make the crystal growths larger. Remember, when evaporation happens in a solution, the chemicals remain in the solution and only the water evaporates.

Try experiments of your own design, evaporating small amounts of various saved solutions and describe the results.

On all of the experiments which you try on your own, be sure to keep detailed notes so that if you discover a new crystal you can reproduce your results again.

TROUBLESHOOTING: WHAT IF MY CRYSTALS DON'T GROW?

If crystals do not grow properly there can be several reasons. If no growth is observed, you have probably used too much water. If this is the case, just remove the solution and re-boil it in a saucepan which is no longer used for cooking. Let the solution cool and pour it back into the crystal growing cup. If you use too little water, you may get many very small crystals. In this case, simply add a bit more water to your growing solution, reheat it, cool it, and add it back to your crystal growing cup.

Sometimes the type of "base rocks" which are used will hinder the growth of crystals. Some "base rocks" seem not to accept crystals growing on them. You will have to experiment with what type of "base rock" works best with your different procedures.

Always try to keep good records, and carefully measure all chemicals and water to make your solutions.

The temperature in the room which you select for your crystal growing is an important factor. The temperature should remain fairly constant and unchanging. Humidity in the air also will cause changes in crystal growth. Humidity affects how fast the solutions will evaporate and therefore how long it will take for some crystals to grow.

While crystals are growing, try not to disturb them. You may use your flashlight to observe their growth, but try to do so without disturbing the crystal growing cup.

LIST OF SET CONTENTS

- 1 Packet "Frosty Diamond" crystal growing chemical (Aluminum potassium sulfate)
- 1 Packet "Amethyst Geode" crystal growing chemical (Aluminum potassium sulfate and food dye colorant)
- 1 Packet Geode shell plaster (Calcium sulfate)
- One Pair Safety goggles
- One Size "A" plastic crystal growing cup
- One Size "B" plastic crystal growing cup
- One Size "C" plastic crystal growing cup
- Two Size "E" plastic crystal growing cups
- One Plastic geode mold
- Two Wooden spatulas
- 12" Monofilament plastic thread
- One Instruction booklet
- One Graduated measuring cup marked in "ml" (milliliters), "cc" (cubic centimeters), as well as in "oz" (ounces)
- One Magnifying glass
- One Poly bag containing granite "base rocks"

DEAR CUSTOMER:

If you found any problems with this set, we would like to help. Please write to us and send the following:

1. Date of Purchase
2. Where Purchased
3. Price Paid
4. Model Number
5. Name of Item
6. Brief description of Problem
7. Include Sales Slip

We will do our best to satisfy you. Send your letter to:

NATURAL SCIENCE INDUSTRIES, LTD.
910 ORLANDO AVENUE
WEST HEMPSTEAD, N.Y. 11552
ATTENTION QUALITY CONTROL DEPT.