

# CRYSTAL GROWING



Please observe the safety information, the advice for supervising adults on page 4, the safety rules on page 5, the information regarding the handling of the chemicals and their environmentally sound disposal on pages 6 to 9, and the first aid information.

**WARNING.** Not suitable for children under 10 years. For use under adult supervision. Contains some chemicals which present a hazard to health. Read the instructions before use, follow them and keep them for reference. Do not allow chemicals to come into contact with any part of the body, particularly the mouth and eyes. Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 10 years old.

**WARNING** — Chemistry Set. This set contains chemicals and parts that may be harmful if misused. Read cautions on individual containers and in manual carefully. Not to be used by children except under adult supervision.



## What's in your experiment kit:

**NOTE!** Please check all the parts against the list to make sure that nothing is missing. If you are missing any parts, please contact Thames & Kosmos customer service.

Any materials not contained in the kit are marked in *italic script* in the "You will need" boxes.



First, check all the labels to make sure you have the right chemicals.

## Checklist: Find – Inspect – Check off

✓	No.	Description	Quantity	Item No.
<input type="checkbox"/>	1	Geode mold and basin	1	703 028
<input type="checkbox"/>	2	Mold for figures and shapes	1	703 029
<input type="checkbox"/>	3	Plaster (calcium sulfate) bag	1	770 800
		Potassium aluminium sulfate (potassium alum):		
<input type="checkbox"/>	4a	50 g packet	1	771 061
<input type="checkbox"/>	4b	20 g packet	4	772 060
<input type="checkbox"/>	5	Sodium acetate	1	771 062
<input type="checkbox"/>	6	Sodium sulfate	1	771 063
<input type="checkbox"/>	7	Lid remover	1	070 177
<input type="checkbox"/>	8	Pipette	1	232 134
<input type="checkbox"/>	9	Wooden spatula	3	000 239
<input type="checkbox"/>	10	Packet of dye tablets	1	039 051

✓	No.	Description	Quantity	Item No.
<input type="checkbox"/>	11	Measuring cup, 200 ml	1	702 810
<input type="checkbox"/>	12	Lid for measuring cup	1	087 087
<input type="checkbox"/>	13	Measuring cup, red, 30 ml	1	065 099
<input type="checkbox"/>	14	Measuring cup, blue, 30 ml	1	065 100
<input type="checkbox"/>	15	Measuring cup, yellow, 30 ml	1	065 101
<input type="checkbox"/>	16	Lid for measuring cup, small	3	061 160
<input type="checkbox"/>	17	Treasure chest	1	700 739

**You will also need:** *distilled water (about 1 liter), adhesive labels, pencil, transparent tape, thermometer, paper towels, pot holders, small, worn-out cooking pot (20 cm diameter), electric hot plate or electric kettle, at least 6 empty jelly or honey jars with lids (about 200 ml capacity), yarn or nylon string, scissors, all-purpose glue, old newspapers, empty yogurt container (250 ml), small pebbles, sandpaper, cloth handkerchief, knife, rubber band*

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**EXPERIMENTS**

**Growing Crystals ..... 12**

Would you like to fill up your treasure chest with cool crystals? Begin right away with the experiments in this chapter. Here's where you will be able to start making your very own crystals.

**Crystal Decorations ..... 22**

A miniature blue dolphin, a glittering pyramid, or a shining red star — grow sparkling crystals on your home-poured plaster shapes.

**Crystal Geodes ..... 28**

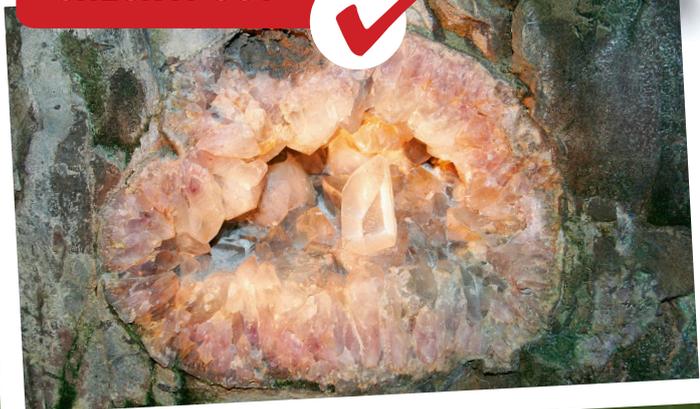
You friends will be astonished when you present them with the ultimate expression of your crystal-growing skills: crystal geodes that you can paint with your favorite colors.

**Publisher's information ..... inside back cover**

**TIP!**

You will find supplemental information in the "Check it out" sections on pages 21, 26, 27, and 32.

CHECK IT OUT



HOW LONG HAVE MINERALS EXISTED?

About 4.6 billion years ago, Earth was formed out of a giant cloud of dust in space. As it became more and more compressed, it heated up and turned into a glowing ball of fire orbiting the Sun. When that happened, the materials inside it separated according to their weight. **The heavy, liquid iron** sank to the bottom to form Earth's core, while the lighter materials made of oxygen, silicon, aluminium, and other chemical elements that were likewise still liquid floated to the top and formed Earth's mantle.

Earth cooled off, the surface hardened, and the liquid rock began to crystallize. That's how the first minerals were formed.

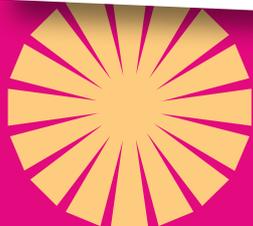
CRYSTALS & ENGINEERING

Natural and artificial crystals have found their way into new technologies. **Silicon crystals**, for example, serve to help generate electricity in solar cells. Pocket calculators and other electronic gadgets contain microchips made of silicon too. **Quartz crystals**, on the other hand, have a special quality: They can be nudged into performing electrical oscillations so they can be used as a clock or timer, much like a clock's pendulum. This comes in handy in quartz watches.

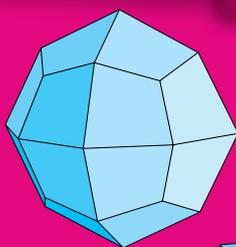


SALT FROM THE SEA

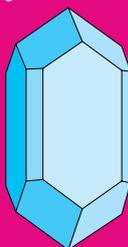
Seawater contains about 35 g of salt per liter. In warm countries, people fill large basins along the coasts with water, let it evaporate over a period of months under the hot sun, and then shovel together mounds of the resulting salt crystals. This kind of facility for obtaining salt is called a **salt evaporation pond**.



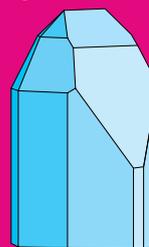
1. Cubic  
e.g. garnet



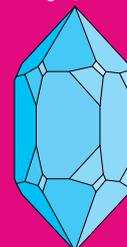
2. Tetragonal  
e.g. rutile



3. Orthorhombic  
e.g. topaz

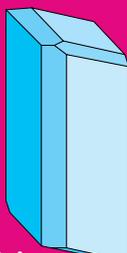


4. Trigonal  
e.g. quartz

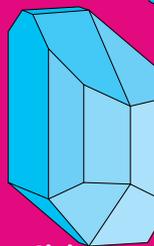


7 DIFFERENT CRYSTAL TYPES

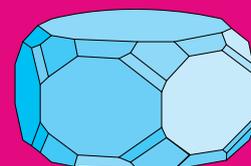
Crystals are divided into these 7 categories according to the regular arrangement of their surfaces:



5. Triclinic  
e.g. rhodonite



6. Monoclinic  
e.g. azurite



7. Hexagonal  
e.g. apatite

## EXPERIMENTS 11, 12, AND 13

## Colorful crystals

## YOU WILL NEED

- > 20 g alum packet
- > Dye tablets
- > Small measuring cup
- > Large measuring cup
- > Pipette
- > Wooden spatula
- > Distilled water
- > Empty jelly jar
- > Pot with hot water (no longer boiling)
- > Paper towels
- > Old newspapers
- > Pot holders

## HERE'S HOW:

1. Spread out sheets of old newspaper across your work surface and prepare the dye solution. Break off about a quarter of a dye tablet and dissolve it in some distilled water in a small measuring cup.
2. Prepare a hot, saturated alum solution in a jelly jar out of 20 g of alum and 80 ml of distilled water, as you did in Experiment 1, and add the dye solution to it using the pipette.
3. Let the jar sit in a quiet place for a few hours or days, until the alum crystallizes. Finally, shake out the crystals onto a paper towel and let them dry. Save them in your treasure chest.

## EXPERIMENT 12:

1. Repeat Experiment 4 by redissolving the alum crystals, but this time use a dye tablet to color the large crystal.

## EXPERIMENT 13:

1. You should have enough alum solution or undesirable alum crystals laying around to make one final colored crystal. Try blending two dyes! Don't use the final 20 g alum packet — you'll need it for Experiment 15.



Be careful when handling hot water!



## WHAT'S HAPPENING ?

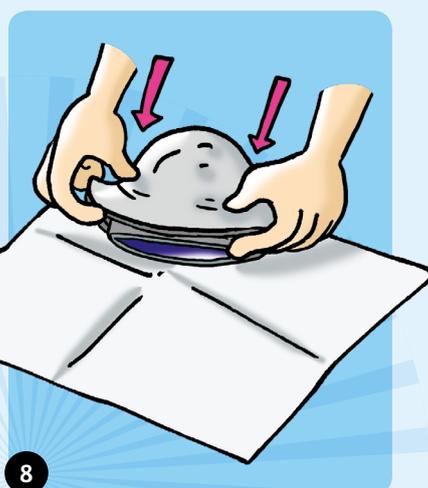
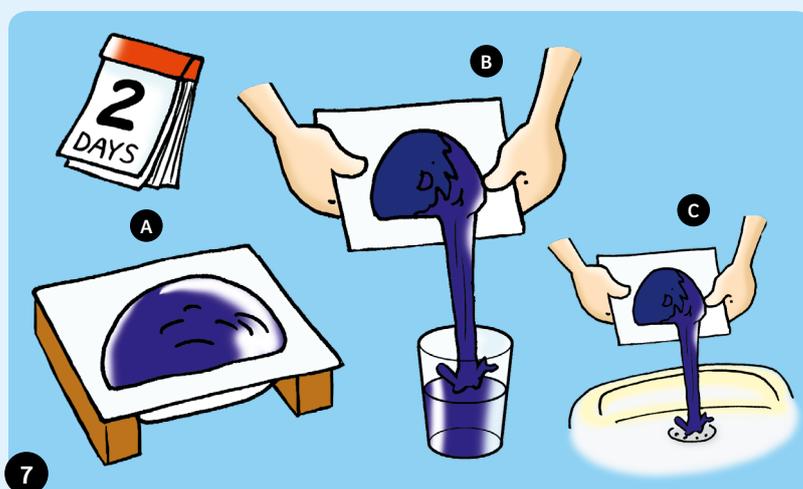
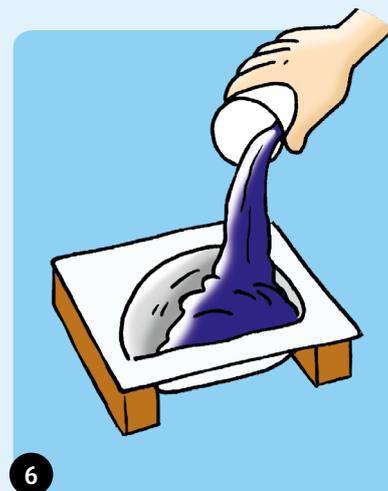
Even though all the chemicals in this kit form colorless crystals, you have now made colored alum crystals by using the dye tablets. As the crystals grow, small quantities of dye become integrated into the crystal structure — exactly how much depends on how much dye you use and also on chance.

## TIP!

You can adjust the color intensity by adding more or less dye solution to the crystals, or change the color by blending different dyes together.

## EXPERIMENT 15

5. Meanwhile, set the plaster mold in a quiet place and support its sides so it can't tip over. You can use the polystyrene tray from the kit if you like.
6. Once the solution has cooled sufficiently, pour it into the plaster geode up to the brim. It will be hard to prevent some from seeping between the plaster and the plastic mold, but it won't really matter. Be careful not to let any of the dye solution spill outside of the mold.
7. Let the geode sit quietly for two days. Then, carefully pour off the dye solution into the measuring cup and take a look at your geode. Be careful: it's still dripping! If you want bigger crystals, pour the dye solution back in and let it sit a few more days. Otherwise, pour the dye solution down the drain along with a lot of water. Be careful: the solution can stain the sink!
8. Let the crystal geode dry for a day. Then you can carefully release it from the plastic mold by loosening the edges of the mold a little and then pushing firmly from the bottom. It's best to do this over an old sheet of newspaper. The crumbs of colored plaster that fall out in the process can be thrown away in the trash along with the newspaper.

**TIP!**

If you want to make the edges of your geode more attractive, carefully smooth them with a sheet of sandpaper.