Please observe the safety information, the advice for supervising adults on pages 4, the safety rules on page 5, the handling of chemicals and their environmentally sound disposal on pages 6 to 9, and the first aid information.
What's in your experiment kit:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Geode mold and basin</td>
<td>1</td>
<td>703 028</td>
</tr>
<tr>
<td>2</td>
<td>Mold for figures and shapes</td>
<td>1</td>
<td>703 029</td>
</tr>
<tr>
<td>3</td>
<td>Plaster (calcium sulfate) bag</td>
<td>1</td>
<td>770 800</td>
</tr>
<tr>
<td>4a</td>
<td>Potassium aluminium sulfate (potassium alum): 50 g packet</td>
<td>1</td>
<td>771 061</td>
</tr>
<tr>
<td>4b</td>
<td>Potassium aluminium sulfate (potassium alum): 20 g packet</td>
<td>4</td>
<td>772 060</td>
</tr>
<tr>
<td>5</td>
<td>Sodium acetate</td>
<td>1</td>
<td>771 062</td>
</tr>
<tr>
<td>6</td>
<td>Sodium sulfate</td>
<td>1</td>
<td>771 063</td>
</tr>
<tr>
<td>7</td>
<td>Lid remover</td>
<td>1</td>
<td>070 177</td>
</tr>
<tr>
<td>8</td>
<td>Pipette</td>
<td>1</td>
<td>232 134</td>
</tr>
<tr>
<td>9</td>
<td>Wooden spatula</td>
<td>3</td>
<td>000 239</td>
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<tr>
<td>10</td>
<td>Packet of dye tablets</td>
<td>1</td>
<td>039 051</td>
</tr>
<tr>
<td>11</td>
<td>Measuring cup, 200 ml</td>
<td>1</td>
<td>702 810</td>
</tr>
<tr>
<td>12</td>
<td>Lid for measuring cup</td>
<td>1</td>
<td>087 087</td>
</tr>
<tr>
<td>13</td>
<td>Measuring cup, red, 30 ml</td>
<td>1</td>
<td>065 099</td>
</tr>
<tr>
<td>14</td>
<td>Measuring cup, blue, 30 ml</td>
<td>1</td>
<td>065 100</td>
</tr>
<tr>
<td>15</td>
<td>Measuring cup, yellow, 30 ml</td>
<td>1</td>
<td>065 101</td>
</tr>
<tr>
<td>16</td>
<td>Lid for measuring cup, small</td>
<td>3</td>
<td>061 160</td>
</tr>
<tr>
<td>17</td>
<td>Treasure chest</td>
<td>1</td>
<td>700 739</td>
</tr>
</tbody>
</table>

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<td>1</td>
<td>700 739</td>
</tr>
</tbody>
</table>

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.

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.
Safety warnings ................................................................. front cover
First aid and poison control information .......... inside front cover
An experiment to hit the ground running ......................... 1
Kit Contents ................................................................. 2
Table of Contents .......................................................... 3
So nothing goes wrong: A word to parents ......................... 4
Basic rules for safe experimentation (safety rules) ................ 5
Practical tips for growing crystals ................................. 6
Information on handling chemicals ......................... 6
Waste disposal ................................................................. 9

Crystals: Miracles of Nature ........................................... 10
Introduction: Basic concepts for crystal growers ............... 11

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.
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.

7 DIFFERENT CRYSTAL TYPES

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

1. Cubic e.g. garnet
2. Tetragonal e.g. rutile
3. Orthorhombic e.g. topaz
4. Trigonal e.g. quartz
5. Triclinic e.g. rhodonite
6. Monoclinic e.g. azurite
7. Hexagonal e.g. apatite
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.

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.
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.