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# GROW COLOSSAL CRYSTALS



 **WARNING:**

This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Instructions & More



# Grow Colossal Crystals

Crystals are everywhere around us. Actually, scientists consider almost any solid a crystal. Salt, sugar, metal, paper, and even your hair are crystals! But the type of crystals we usually think of are called crystalline solids. These are gems like diamonds and quartz, as well as the creations you'll grow with this kit. The molecules (tiny building blocks of matter) of crystalline solids all line up in a rigid, regular three-dimensional pattern. Have you ever been to the supermarket and seen fruit neatly stacked in a repeating pattern? This is just what a crystal is like, only the repeating units are so small you can't see each one!

## ADULT SUPERVISION REQUIRED

This set contains chemicals that may be harmful if misused. Read cautions on individual packages carefully. Do not put any of the chemicals or ingredients from this kit in your mouth. Avoid contact of any chemicals, solutions, or crystals with skin, eyes, or mouth. Always wash your hands after handling chemicals, solutions, or crystals.

1. Read through all the instructions carefully before doing each activity.
2. Reseal each ingredient package provided in the kit when you are done with it.
3. Clean your cups, spoons, bowls and other utensils before you begin and after you finish the activities.
4. After you measure a liquid or powder with the measuring beaker, rinse and dry it before measuring a different liquid or powder. This keeps your ingredients pure, and you'll get the best results.
5. Roll up your sleeves and put on an apron or old T-shirt.
6. The red MAP solution may stain. If you spill it on your clothing, immediately wash the area with hot water and heavy duty liquid detergent.
7. Find a smooth, flat surface to work on, such as a counter or table. Cover it with newspaper to catch any spills.

### What You'll Find in Your Kit

Clear Monoammonium Phosphate (MAP)  
12 oz (340 g)  
Red Monoammonium Phosphate (MAP)  
4 oz (113 g)  
Thread  
2 stir sticks  
1 (8 oz) cup  
2 (12 oz) cups  
1 measuring beaker

### What You'll Need to Get or Use

Cooking pot (not aluminum) or microwave safe bowl  
Stove or microwave oven  
Small mixing bowl  
Pencil  
Tape  
3 jars or storage containers with lids  
Plastic wrap  
Paper towels  
Magnifier (optional)  
Water  
Label  
Scissors

# Before You Begin

## Crystal growing tips

- Patience is a virtue. Good crystals take time to grow. But if you don't see any growth in a week, move the cup to a warmer and drier place.
- If the crystals are turning out really cloudy, it means the water is evaporating too fast. Loosely cover the cup with plastic wrap to slow the evaporation.
- Try to avoid letting dust or other particles fall onto the surface of your crystal growing solutions. If the space where your crystals grow is dusty, you may want to loosely cover the cup with plastic wrap.

## Solids and Solutions

Open the plastic bag of clear monoammonium phosphate (or just MAP for short), and look closely at the powder. If you have a magnifier handy, use it. Is the powder a solid, liquid, or gas? Powders like this one are made up of lots of tiny pieces of solid, each with a rigid shape. Look again. Do you see the tiny gem-like crystals? With the help of some water, you're about to turn these miniature gems into colossal crystals.

You've probably dissolved salt, sugar or another powder in a liquid before. But did you ever stop to wonder what's really going on? When salt dissolves in water, the tiny salt molecules break apart and move about freely in the water. The result is a salt solution. The first step in growing colossal crystals is to make a solution of monoammonium phosphate.

## The MAP Solution

### What You Need From Your Kit

Clear MAP  
Measuring beaker  
Stir stick

### What You Need to Get

Water  
Cooking pot (not aluminum) or microwave-safe bowl for boiling water  
Stove or microwave oven  
Small mixing bowl  
Jar or storage container  
Label

### What you do

1. Bring 500 cc (about 2 1/4 cups) of water to a boil. (Note: cc is the same as ml). Let it sit until the bubbling stops.
2. While you're waiting for the water to boil, measure 150 cc (5 oz.) of clear MAP and put it in the mixing bowl.
3. **Carefully** pour 400 cc (1 3/4 cups) of the hot water into the mixing bowl with the MAP. Throw out the rest of the water. Stir until the MAP is completely dissolved. This may take a few minutes.

4. Let the MAP solution cool, then pour it into a jar or other container with an airtight lid. Label the container and store it in a place where it won't be disturbed. *Alternate Method to heat water:* Heat 1 3/4 cups water in microwave safe bowl for 1-2 minutes. **Carefully** remove from microwave and pour into the mixing bowl with the MAP.

### Solution Science

You just made a saturated solution of MAP. This means there's so much MAP dissolved in the water, it can't possibly hold any more!

## Growing Seed Crystals

### What You Need From Your Kit

MAP solution you made  
8-oz. growing cup

### What You Need to Get

Place to let your crystals grow  
Paper towels  
Empty storage container  
Plastic wrap

### What you do

1. Pour enough MAP solution into the 8-oz. cup to fill it about half way.
2. Set it on a shelf or other space where it won't be disturbed.
3. Let it sit for at least 24 hours. Crystals should start to form in a day, but good seed crystals will take at least three days to grow.
4. Let the crystals grow until the largest ones are about the size of a pea or small grape. Then carefully pour the remaining solution back into your MAP solution storage container. Be careful not to let any of the crystals fall into the storage container.
5. Dump out all the crystals onto a paper towel, pat them dry with another paper towel, and let them air dry.
6. Keep your crystals in a storage container for later.

**Special Tip:** Wash your hands before handling your seed crystals. Oils and dirt particles from your hands may hinder further growth.

### How Does It Work?

Remember that your solution is saturated? As the water evaporates, there's no more room in the solution to hold all the MAP molecules. So the MAP molecules come out of the solution and join together in a very regular three dimensional structure (like the fruit stack). Remember what that's called? It's a crystalline solid!



# Growing a Colossal Crystal

## What You Need From Your Kit

12 oz. cup  
Thread  
Seed Crystals  
MAP solution you made

## What You Need to Get

Pencil  
Tape  
Scissors  
Paper towels  
Plastic wrap

## What you do

1. Inspect your collection of seed crystals and choose the best one - the largest, clearest and simplest in shape.
2. Tie one end of the thread around your seed crystal. Use a double knot to make sure the crystal hangs securely from the thread. This step is tricky - you may need an adult to help you tie the delicate thread.
3. Cut the thread so there's about 6 inches coming off the crystal. Keep the rest of the thread for growing more crystals. Cut off the extra thread around the knot.
4. Tape the end of the thread to the center of a pencil and wind it around the pencil until the crystal hangs about 1 inch below the pencil. Place the pencil across the rim of the 12-oz. cup. Adjust the thread so the crystal hangs in the center of the cup. Finally, put a piece of tape over the windings to keep the thread secure.
5. Gently pour the MAP solution into the 12-oz. cup up to about a 1/2 to 1/4 inch from the rim.
6. Put the cup where it won't be disturbed to let your crystal grow. Within a week, you'll notice it has increased in size. The longer you wait, the bigger it will grow! Just make sure the crystal stays completely submerged in the solution. Add more solution if needed. If you run out of solution, just make some more as you did before.
7. When you're happy with the size of your crystal, take it out of the MAP solution, dunk it quickly in cold water, set it on a paper towel, and use another paper towel to pat it dry. Pour the leftover MAP solution back into the storage container.
8. After the crystal is dry, cut off the string and display your prized jewel to amaze your friends and family!

## Special Tips:

- If the crystal outgrows the cup and you want it to grow even larger, you can transplant it into your own larger cup. Adjust the length of the thread so that it hangs in the center of the solution.
- Avoid letting the crystal touch the bottom or sides of the cup.
- If other crystals start growing on the bottom of the cup, remove them—they'll take away from the colossal crystal growth. But keep these pesky crystals because you can recycle them later.

### How Does It Work?

As the water evaporates, the MAP molecules come out of solution—just like when you grew the seed crystals. But this time, they collect on the seed crystal, because they prefer to stick to their own kind rather than the plastic container.

## The Red MAP Solution

### What You Need From Your Kit

Red MAP  
Measuring beaker  
Stir stick

### What You Need to Get

Water  
Cooking pot (not aluminum) or microwave-safe bowl for boiling water  
Stove or microwave oven  
Small mixing bowl  
Jar or storage container.

### What you do

1. Bring 450 cc (about 2 cups) of water to a boil. Let it sit until bubbling stops.
2. While you're waiting for the water to boil, measure 110 cc (4 oz.) of red MAP and put it in the mixing bowl.
3. Pour 300 cc (1 1/4 cups) of the hot water into the mixing bowl with the red MAP. Throw out the rest of the water. Using your stir stick, stir until the red MAP is completely dissolved. This may take a few minutes.
4. Let the red MAP solution cool, and pour it into a jar or other container with an airtight lid. Label the container and store it in a place where it won't be disturbed. See page 3 for alternate method to heat water using microwave.

## Brilliant Red Crystal Clusters

### What You Need From Your Kit

Red MAP solution  
12-oz. cup

### What You Need to Get

Paper towels  
Plastic wrap

### What you do

1. Pour enough solution into the 12-oz. cup to fill it about half way.
2. Put the cup on a shelf or place where it won't be disturbed.
3. Let the crystals grow at least one week. They will begin as individual crystals, but as they continue to grow, they'll form clusters on the bottom of the cup.
4. Since the solution is very dark, you may need to shine a bright light into the cup to see the crystals.
5. Just as before, you may need to add more solution to be sure the crystals stay completely submerged.

6. When you're satisfied with the size of your crystal clusters, pour the remaining solution back into your red MAP storage container. Remove the crystals, place them on a paper towel, and use another paper towel to pat them dry. If any crystals are stuck to the bottom, turn the cup upside down over the paper towel and gently tap the bottom.

7. When they're dry, put your dazzling gems on display. You might convince someone they're real rubies!

### **How Does It Work?**

Mononammonium phosphate is naturally clear. Red MAP is made by adding a red dye to the powder, which dissolves in the water when you make the solution. As the water evaporates and the MAP molecules join together, some of the dye molecules get trapped between MAP molecules, creating a red crystal.

## Going Further

You're not done yet, are you? Now that you've got the hang of crystal growing basics, try these other ideas.

### Clear Crystal Clusters

Use some of your leftover clear MAP solution to grow crystal clusters in one of the 12-0z. cups.

### Red Colossal Crystals

Pick one the smaller red crystals clusters, or break off a piece from one of the larger ones. Tie a piece of thread around it and hang it in a cup of red MAP solution, just like what you did in the Colossal Crystal activity. Give it a few weeks and you'll have red Colossal Crystals!

### More Colors!

You can purchase liquid food coloring at your local supermarket. Choose a new color you want your crystals to be. Add a generous amount of coloring to some of the clear MAP solution and use it to grow crystals. The darker the solution, the more brilliantly colored your crystals will be.

### Do It Again!

You've got enough Clear MAP to grow even more Colossal Crystals! Make more solution as you did before. You can use one of the seed crystals you've already grown or grow new ones.

The recipe calls for 150 cc of MAP and 400 cc of water, and it makes 400 cc of solution. If you need to make a smaller or larger recipe, follow these tips:

- Take the number of cc's of MAP you want to use and divide it by 0.367 to get the number of cc's of hot water to use. Or...
- Take the number of cc's of solution you want to get and multiply it by 0.367 to get the number of cc's of MAP to use.

## Recycle

Were there any crystals you weren't satisfied with? Did you have extra seed crystals or any pesky crystals you removed from the bottom of the Colossal Crystal growing cup? Just recycle them!

Put your extra crystals in a mixing bowl. Add hot water, little by little, while stirring to dissolve the crystals. Add just enough water to completely dissolve the crystals. You want to make a saturated MAP solution. If you add too much water, let the solution sit and evaporate in an open container until crystals start to grow on the bottom. At this point, the solution has become saturated. Then store it in a closed container and use it to do even more experiments!