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Introduction

Matter, the stuff that makes up everything in the universe, can exist in one of three different states – solid, liquid or gas. Solids are hard and rigid and don’t change shape easily. Rocks, trees, pencils and cars are examples of solids. Liquids are things that flow, make puddles and don’t hold their shape. Water, oil, milk and honey are all liquids. Gases are things that don’t hold their shape and don’t make a puddle. They are very light and flow very easily. Most gases are invisible to your eyes. Bubbles, smells and wind are all evidence of gases. Solids can dissolve in liquids. Think about the sugary powder you mix with water to make a sweet drink. The drink powder is a solid that you dissolve in a liquid – water.

When a solid is dissolved in water, it is called a solution. Even though the dissolved solid has disappeared, it is still in the water. It has broken up into pieces so tiny that you can’t see them! Powders are tricky. You may think they are liquids because they pour, but actually, they’re solids. They are made up of lots of tiny solid pieces.

Activity 1: Dancing Powders:

It’s time to get started on your mind blowing journey in the world of chemistry. Let’s start with this simple activity to learn about acids, bases and chemical reactions.

When water is added to a mixture of citric acid and baking soda, the mixture will quickly and intensely bubble which produces carbon dioxide gas. If your container is sealed, it can build pressure and burst. Always use open (unsealed) containers such as cups and bowls when working with mixtures of citric acid, baking soda and water.

NOTE TO SCIENCE HELPER:

“My First Mind Blowing Science™” is designed for kids ages four and up. Read through this science guide with your child and be there to help with the activities. If necessary, discuss the activities and explanations with your child in your own words. Younger children may want to conduct the activities freely – with less structure. This is fine. With children of all ages, ask lots of questions and encourage fun learning by experimentation. Finally, the activities are arranged to present concepts sequentially, so we recommend that you go through them in order.
MIND BLOWING SCIENCE SECRETS

Acids often taste sour, sting cuts and break down other chemicals. Bases often taste bitter and feel slippery. Neutrals are neither acidic nor basic. They don’t taste sour or bitter. Red cabbage is a natural dye that changes colors depending on how acidic or basic the solution is. Below is a chart that shows how it changes colors.

Going the Extra Mile

What do you think would happen if you tried this again with very warm water? How about very cold? Go ahead and try it to find out!

Activity 2: Color Changing Liquids

Has your mom ever told you to eat your vegetables? You’re about to see that vegetables can be great fun! Let’s use acids, bases and red cabbage powder to make color changing liquids!

What You need from your kit:
- Citric acid
- Baking Soda
- Red cabbage powder
- 3 Plastic cups
- Medium plastic scoop
- Small plastic scoop
- Stir sticks

What You need to get:
- Water
- Plate or tray to catch any spills

What you do:
1. Set one cup on the plate or tray.
2. Add two medium scoops of citric acid and two medium scoops of baking soda to the cup.
3. Stir the cup around to mix the powders together.
4. Fill the second cup half way with water — get ready to dance!
5. Pour the water into the cup with the powders. It’s dancing!

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What You need to get:
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What you do:
1. Fill the first cup ¾ full with water. Do the same with the second cup. Set them both on a tray or plate.
2. Add one small scoop of red cabbage powder to each of the cups. Don’t stir them yet. It’s like a purple waterfall! Stir the cups to mix the powder and water.
3. Now you’ve got two cups of purple water. Get ready to blow your mind. Add one medium scoop of baking soda to one of the cups and stir it in. It changed color!
4. Add one medium scoop of citric acid to the second cup and stir it in. It changed color, too! What color did it change to this time?
5. Put the third cup on the plate or tray. Pour about 1/3 of your red water into this cup. Pour about 1/3 of your blue water into the same cup. It changed back to purple — and it’s fizzing and bubbling, too!

Keep Up the Fun

6. Add one medium scoop of baking soda to the purple cup and stir it in. Did it turn bluer? Wait for the foam to go away and then add another medium scoop of baking soda to the cup. Did it turn even bluer?
7. Add one medium scoop of citric acid to the cup, but don’t stir it. Watch how the color change starts at the top of the cup and moves down to the bottom.
8. Wait for the foam to go away and then add another medium scoop of citric acid. It’s back to purple again.
9. What do you think will happen if you keep adding more citric acid? Try it and find out!

10. When you’re done, remember to clean and dry your cups and utensils.
chemical in red cabbage that gives it color is slowly breaking apart into other, colorless chemicals.

Activity 3: Acid or Base?

Let’s test some safe household liquids to find out if they are acids or bases.

What You need from your kit:
- Red cabbage powder
- Small plastic scoop
- 2 plastic cups
- Pipette
- Stir sticks

What You need to get:
- Water
- Safe household liquids to test

What you do:
1. Fill one plastic cup ¼ with water. Add two small scoops of red cabbage powder and stir it in. You now have a purple indicator solution.
2. Ask your adult assistant to help you find some safe household liquids to test. Here are some suggestions: lemon juice, water, soda pop, liquid soap, dry soap dissolved in water, milk, apple juice, grapefruit juice, tea, vinegar, toothpaste dissolved in water and baking powder dissolved in water.
3. Pour a small amount of the liquid you want to test into the empty plastic cup. Use the pipette to add a few drops of the purple indicator to the liquid. It will change to a color. If it turns pink or red, then the liquid is an acid. If it changes blue or green, then the liquid is a base. If it stays purple, then the liquid is neutral.
4. Rinse out the cup before testing a different liquid.

Activity 4: Colorful Jiggly Crystals

What You need from your kit:
- Citric acid
- Baking soda
- Red cabbage powder
- Cross-linked Polyacrylamide crystals
- 3 plastic cups
- Medium plastic scoop
- Small plastic scoop
- Stir sticks

What You need to get:
- Water
- Plate or tray to catch any spills

What you do:
1. Fill two of the cups ⅔ full with water and set them on the plate or tray.
2. Add one medium scoop of baking soda to the first cup and stir it in. Rinse and dry scoop. Add one medium scoop of citric acid to the second cup and stir it in.
3. Add one small scoop of red cabbage powder to each of the two cups. Just for fun, don’t stir in the red cabbage powder yet. Watch what happens as it mixes on its own. Then go ahead and stir it in.
4. Set the third empty cup on the plate or tray. Pour about ⅓ of the blue water and ⅓ of the red water into the empty cup. Does this look familiar? Yes, you have red, purple and blue water, just like in Activity 2. Now let’s do something a little different.
5. Add two medium scoops of polyacrylamide crystals to each of the cups. What do you think might happen? Wait an hour and you’ll find out!
6. After about two hours, pour off any extra water that the crystals didn’t absorb. Go ahead and touch your new colorful soft crystals. They squish. They squirm. They’re jiggly crystals.

Going The Extra Mile

Try leaving your jiggly crystals out to let the water evaporate. They’ll shrink back to their original size and you’ll end up with tiny colorful gems!

If you’d like your jiggly crystals to stay soft, cover the cups with plastic wrap or put them in an airtight container so the water doesn’t evaporate.

Activity 5: Test Tube Sunset

Have you ever watched the beautiful colors of a sunset as they change before your eyes? Now you can capture these colors!

What You need from your kit:
- 1 test tube
- Cross-linked polyacrylamide crystals
- Citric acid
- Baking soda
- 2 plastic cups
- Medium plastic scoop
- Stir sticks
- Test tube stand
- Red cabbage powder

What You need to get:
- Water
- Plastic Wrap
**What you do:**

1. Fill both cups ¾ full with warm water.
2. Add one medium scoop of baking soda to the first cup and stir it in. Add two small scoops of red cabbage powder to the same cup and stir in. It will become dark blue.
3. Add one medium scoop of citric acid to the second cup and stir it in. Add two small scoops of red cabbage powder to the same cup and stir in. It will become red.
4. Add three medium scoops of polyacrylamide crystals to the blue cup and four medium scoops of crystals to the red cup.
5. What do you think will happen to the crystals? Wait 15 minutes and find out.
6. Fill the test tube half way with the blue jiggly crystals you just grew. Then fill the rest of the way with red crystals. Pack it tight with crystals and cover with plastic wrap. Place test tube in the test tube stand.
7. After several hours (or overnight), look at the tube of crystals again. How did the purple crystals get in there? Now there's a smooth blend of color from blue to purple to pink. It's like a sunset in a test tube!

**Activity 7: Color Changing Volcano**

This is no ordinary volcano experiment. This volcano erupts with color changing lava. It's totally mind blowing!

**What You need from your kit:**
- Citric acid
- Baking soda
- Red cabbage powder
- 3 plastic cups
- Pipette
- Medium scoop
- Small scoop
- Stir sticks

**What You need to get:**
- Water
- Dinner plate (you'll want a light colored one so that you can see the colors change)
- Flour

**What you do:**

1. Add four medium scoops of baking soda and one medium scoop of flour to the first plastic cup. Add two small scoops of red cabbage powder to the cup.
2. Stir the dry powders to mix them together well. Try to stir out any lumps.
3. Add one medium scoop of water to the cup and stir it until all the powder is moistened. You should have a crumbly paste.
4. Dump the paste onto the plate. Mold it into a mountain shape in the center of the plate. This is your volcano.

5. Fill the second cup ¾ full with water. Add three small scoops of red cabbage powder and stir together.

6. Fill the third cup ¾ full with warm water. Add four medium scoops of citric acid to the cup and stir it in.

7. Pour some of the purple water onto the plate, making a puddle around your volcano. Pretend it’s an island volcano in the middle of the sea. Now get ready for the colorful eruption!

8. Draw up some citric acid solution with the pipette and drop it onto the volcano. It erupts with red lava and changes colors!

9. Do it again! Drop some more citric acid solution onto the volcano. You can keep doing this until the volcano is gone. If the plate gets too full of liquid, you can carefully pour it off into the sink. The volcano will stay stuck to the plate.

10. Try this – Find a spot on the plate where the liquid “sea” is pink or red. Use the medium scoop to make a small mound of baking soda there. Watch what happens. You’ve just made another volcano in the sea!

**Activity 8: Underwater Volcano**

**What You need from your kit:**
- Citric acid
- Baking soda
- Red cabbage powder
- Vegetable oil
- Test tube and cap
- Medium plastic scoop
- Small plastic scoop
- Stir sticks
- Test tube stand

**What You need to get:**
- Water
- Plate or tray to catch any spills
- Clear drinking glass or bottle

**WARNING:** Do not mix baking soda with citric acid and liquid in any closed container.

**What you do:**

1. Fill the test tube with warm water about 1/3 full. Add one medium scoop of baking soda.

2. Add one small scoop of red cabbage powder and gently stir until water is uniformly blue.

3. Slowly pour vegetable oil into the test tube almost up to the lip of the test tube.

4. Set the test tube in the test tube stand and get ready for action!

5. Measure one medium scoop of citric acid. Count down to the eruption. “Three! Two! One!” Then drop the citric acid into the test tube. What’s happening? It’s an underwater volcano—and its changing colors!

6. After the reaction dies down, add another medium scoop of citric acid to set off the eruption again.

7. Wait for the reaction to die down again. By this time, the solution at the bottom is probably pink. What does this tell you about the acidity or basicity of the solution? Yep, it’s acidic. So what do you think will happen if you had used baking soda (a base)?

8. Measure one medium scoop of baking soda and add it to the test tube. What happened? Were you correct?

9. When you’re done having fun with it, be sure to clean out the test tube with soap and water, washing out all of the oil residue.

**Activity 9: Color Changing Grapes**

You’ve seen that a vegetable (red cabbage) can change color. What about a fruit?
What happened when you poured the vegetable oil into the test tube in step three? The oil and water didn’t mix together. Oil floats on top of water because it is less dense than water. Things that are less dense are made of stuff that’s packed together less tightly than things that are denser.

When you added the citric acid powder in step five, it sank to the bottom because it is denser than both oil and water. By now, you can probably guess what happened when the citric acid (an acid) and baking soda (a base) mixed in the bottom of the test tube. Yep, they made a chemical reaction and released carbon dioxide gas.

The carbon dioxide gas forms bubbles that rise to the surface. Some of the bubbles attach to droplets of colored water and carry the water up to the surface of the oil. At the surface, the bubbles pop and the water droplets sink back to the bottom. As the acid and base react with each other, the water solution becomes more neutral. That’s why it changes to purple. As you continue to add more citric acid, it changes more and more to red.

**Activity 10: Magic Ooze**

Is it a solid or a liquid? It’s magic ooze with a mind of its own.

**What You need from your kit:**
- Cornstarch
- 2 Cotton swabs
- 2 Cups
- Stir Stick

**What You need to get:**
- Medium-sized cup or bowl
- Measuring spoons
- Measuring cup
- Spoon for stirring
- Food coloring (optional)

**What you do:**
1. Add 1/8 cup of water to a medium-sized cup or bowl. Optional: Add some food coloring if you’d like.
MIND BLOWING SCIENCE SECRETS

Magic ooze is what scientists call a non-Newtonian fluid. This means that the more pressure you put on it, the thicker it becomes. Scientists still aren’t sure why non-Newtonian fluids do what they do. Try to think of your own explanation. Who knows, you might just be right!

Activity 11: Mix Colors with your Eyes

In the experiment, you'll mix colors—without them ever touching each other!

What You need from your kit:
- 3 Test tubes
- Color tablets
- Test tube stand

What You need to get:
- Water

What you do:

1. Fill one of the test tubes 3/4 full with water.
2. Add five tablespoons of cornstarch to the cup.
3. Use your fingers to mix it all together until it's smooth.
4. That's really weird stuff! Is it a solid or a liquid? Touch it gently and it feels like a liquid. Poke it suddenly and it feels solid. Grab a handful and squeeze it into a ball. What happens when you let go? It has a mind of its own!
5. Now it's time to mix color! Hold the yellow and blue test tubes together and put them up to the light. What color do you see now?
6. Fill the third test tube with 3/4 water and add the red color tablet to.
7. What do you think will happen when you mix blue and red, or yellow and red? Try out any combination you want!

LAB NOTES