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Kitchen Science

I. Opening Circle

As girls come in, gather into a circle to start the program. Introduce yourself and ask them what they are expecting to do during their time with you. One thing that all science experiments have in common is: ***The Scientific Method***. The scientific method is a way to ask and answer scientific questions by making observations and doing experiments. The steps of the scientific method are to:

- **Ask a Question**
- **Do Background Research** (what do you know)
- **Construct a Hypothesis** (best guess of what could happen)
- **Test Your Hypothesis by Doing an Experiment**
- **Analyze Your Data and Draw a Conclusion**
- **Communicate Your Results**

After we've heard the directions for each experiment, we will work as a team to come up with our hypothesis and then do the experiments.

II. Erupting Soap

Walk down the detergent isle and you'll see dozens of different kinds of soap. Green soap, smelly soap, big soap, even soap that floats. Ivory soap is famous for floating. How do they make some bars of soap float and others sink? Believe it or not, we're going to cook the soap in the microwave oven to uncover the secret. What is special about this particular bar?

Materials: bowl of water, bar of Ivory Soap, a bar of another brand of soap, microwave

1. Fill the bowl with water.
2. Drop the bars of soap in the bowl of water. Notice how all of the bars of soap sink except for the Ivory brand soap. Why?
3. Remove the Ivory soap from the water and break it in half to see if there are any pockets of air hiding in the middle of the bar. (By the way, there are no pockets of air! Hmmmm?)
4. Place the bar of Ivory soap in the middle of a piece of paper towel and place the whole thing in the center of the microwave oven.
5. Cook the bar of soap on HIGH for 2 minutes. Don't take your eyes off the bar of soap as it begins to expand and erupt into beautiful puffy clouds. Be careful not to over cook your soap souffle.
6. Allow the soap to cool for a minute or so before touching it. Amazing... it's puffy but rigid.

Ivory soap is one of the few brands of bar soap that floats in water. If it floats in water, it must mean that it's less dense than water. When you broke the bar of soap into several pieces, no large pockets of air were discovered. Ivory soap floats because it has air pumped into it during the manufacturing process. The air-filled soap was actually discovered by accident in 1890 by an employee at Proctor and Gamble. While mixing up a batch of soap, the employee forgot to turn off his mixing machine before taking his lunch break. This caused so much air to be whipped into the soap that the bars floated in water. The response by the public was so favorable that Proctor and Gamble continued to whip air into the soap and capitalized on the mistake by marketing their new creation as "The Soap that Floats!"

Why does the soap expand in the microwave?

This is actually very similar to what happens when popcorn pops. Here's the secret: All soap contains water, both in the form of water vapor inside trapped air bubbles (particularly important in the case of Ivory) and water that is caught up in the matrix of the soap itself. The expanding effect is caused by the heating of the water that is inside the soap. The water vaporizes, forming bubbles, and the heat also causes trapped air to expand. Likewise, the heat causes the soap itself to soften and become pliable. This effect is actually a demonstration of Charles' Law. When the soap is heated, the molecules of air in the soap move faster, causing them to move far away from each other. This causes the soap to puff up and expand to an enormous size. Charles' Law states that as the temperature of a gas increases so does its volume. Other brands of soap without whipped air tend to heat up and melt in the microwave.

III. **Chocolate Covered Bananas**

Ask the girls to name things in the room they see. Tell if what they see is a solid, liquid or gas. Explain that each and everything they've named is made of "matter." Matter is made of tiny atoms. Heat and changes in pressure can change the state of matter (water is liquid- steam is gas- ice is solid). Chocolate is solid. What happens when heat is applied? The girls have now learned about how microwaves can heat things up to expand. Ask the girls how long they think it would take to turn chocolate chips into a melted state.

Materials: bananas, knife, chocolate chips, spoon, microwave, paper bowl, napkin

1. Place the chocolate chips into a paper bowl.
2. Start testing out the melting point of chocolate chips at 30 seconds or less if that is their hypothesis.
3. Remove the bowl and show the girls every 30 seconds until they are fully melted.
4. Give each girl a napkin and a half a banana with peel on it.
5. Each girl will peel their own banana and dip it into the melted chocolate to eat. While the group talks about how the microwave worked.

A microwave uses electromagnetic waves to make the liquid molecules in food vibrate back and forth very fast against each other. This causes friction (like rubbing your hands together), and the resulting heat causes the food t o warm or cook. When chocolate is heated, its molecules move faster and further apart, allowing it to liquefy. When you freeze the chocolate, its molecules slow down and the chocolate solidifies.

IV. **Blowing up a Balloon**

Materials: A bottle with a narrow neck, Vinegar, Baking soda, Funnel or straw, Water Balloon

1. Pour about an inch of liquid--half vinegar, half water--into the bottle.
2. Use the funnel to fill the balloon half full of baking soda. If you don't have a funnel, you can use a straw to load the balloon. Stick the straw into the baking soda, and put your finger over the top of the straw. Lift the straw out, put it into the balloon, and blow or tap gently.
3. Stretch the open end of the balloon over the neck of the bottle. Make sure it's on tight! Let the heavy end of the balloon dangle, so no baking soda goes in the bottle.
4. Hold onto the balloon at the bottle neck, and pick up the heavy part of the balloon so that all the baking soda falls into the vinegar at the bottom of the bottle.
5. Wow! Hear the fizz? There are thousands of bubbles! And look at what's happening to the balloon...

Why did the balloon inflate? The reason for that is because vinegar and baking soda react to produce carbon dioxide. Now we know that a gas occupies as much volume as is available to it. So the carbon dioxide produced occupies the space in the balloon. When more gas is produced, it exerts pressure on the sides of the balloon. Since balloons are stretchable, they expand as the amount of gas increases. They keep on expanding as more gas is produced and we witness this as the balloon blows up.

Now, why do vinegar and baking soda give off carbon dioxide? Actually, vinegar is a solution of acetic acid. Baking soda, in chemical terms, is sodium bicarbonate.

V. **Bending Water**

Materials: Styrofoam cups, toothpicks, water

1. First you need to make a divide that will drip a steady narrow stream of water. To make the device, just push a toothpick into the bottom of a Styrofoam cup, but leave the toothpick in the hole at the base of the cup.
2. Fill the cup with some water, but don't remove the toothpick yet. When it's left in the toothpick plugs the hole that is made, and the cup won't leak. You now have your own dropper.
3. Take another empty Styrofoam cup and rub it on your hair. This rub gives the cup and electric charge, so rub it good.
4. Now you'll need some help. Have someone place the third empty cup on a table and have him or her hold the "dripper" directly above it. Pull the toothpick plug on the "dripper" and allow the water to flow into the empty cup below.
5. Now hold the charged cup near the stream of water. Make sure the part of the cup that was rubbed on your head is closest to the running water. You'll be amazed by what happens next.
6. The stream of water bends towards the charged cup! Try not to get too much water on the charged cup.

Everything is made up of tiny parts called atoms. These atoms have three parts: neutrons, protons and electrons. Neutrons are not involved in this experiment so we'll just think about the protons and electrons. Protons and electrons have opposite electric charges. An electric charge is usually written as a positive (+) and a negative (-). Take a look at a battery and you'll see these signs at either end – electric charges make electricity flow.

Inside the atom, the protons have a positive charge (+) and the electrons have a negative charge (-). Normally, each atom has the same number of positive and negative charges, so that they cancel each other out and the whole atom has no electric charge (we call this neutral). When you rubbed the cup against your hair, you pulled some of the electrons out of the plastic atoms. Now those electrons are on your hair! Because there are less electrons on the cup, the cup atoms now have more positive charge than negative – the whole atoms are positive. This kind of charge is called static electricity. Opposite electrical charges attract each other. Water atoms have a positive end and a negative end. When you bring the cup close to the water, the atoms turn round so their negative end is facing the cup and they try to get to it.

VI. **Playdough**

Before beginning this activity, place the ingredients on a table that is viewable by girls. Ask the girls the following: *Does anyone recognize these items I have placed on the table? What if I told you that we can take these ingredients and make something that is completely different than the individual ingredients? Do you think that we could do that? Do any of you know what we could make with these ingredients?*

Materials: flour, salt, water, food color, liquid detergent, paper bowls.

Have the girls working in pairs and one girl gets the wet ingredients and one gets the wet.

1. Mix the flower and salt in a large bowl.
2. In a separate bowl, mix all liquids together, and then slowly add to the dry ingredients.
3. Using your hands, knead to mix, adding more water by teaspoons if necessary for proper consistency.
4. Store in a Ziploc bag to take home.

Have the girls to think about what they just created by asking the following:

What does it feel like? What do you think we have made? Is this like any of the starting ingredients? Why or why not? How is this substance different? What would happen if we left out the water? Flour?
What do you think would happen if we added an extra cup of flour? How do you think we could find out?
Do you think that each of the parts or ingredients that we added was important? Do you see, smell, or feel any evidence of the original parts? Do you think that we could divide the play dough back to the original ingredients? Why or why not?
Has anyone ever seen parts put together to make a whole substance that is different? Where and what?

VII. **Closing activity**

Girls will assist in cleaning up from the experiments, since a Girl Scout leaves a place better than she found it.