girl scouts of wisconsin badgerland

# Chemistry Try-It

Girl Scouts of Wisconsin – Badgerland Council
For Girl Scout Brownies

## Created by U.W. Madison's Alpha Chi Sigma Chemistry Fraternity

To earn the Brownie Chemistry Try-it girls must complete 4 of the 5 sections to earn the Try-It. Try-It's are available for purchase in the Black Hawk Council Trefoil Shop.

### 1) Acid/Base Interactions

What is the difference between an acid and a base? What does the term pH mean? How can we test the acidity of a solution? What is an indicator?

pH is a scale that scientists use to decide if things are acids or bases. Acids are solutions that measure a low number on the pH scale. Anything with a pH below 7 is an acid. Bases are solutions whose pH is above 7. The lower the pH number the stronger the acid; the higher the pH number the stronger the base. Acidic substances are usually sour (though never taste a substance to test this). Some common acids include citric acid found in orange juice or ascorbic acid found in soda pop. Your stomach also contains acid that helps you digest the food that you eat. Bases are usually bitter (again never taste substances to test this). They are commonly slippery to the touch and are found commonly as detergents and household cleaners.

**At home experiment:**
Obtain some litmus or pH paper from a local hobby shop. Test the strength of different solutions around your house by placing the pH paper into the liquid then observing the color of pH paper after removing it from the liquid. The pH paper will come with a chart to help you match the color of your paper to a number scale telling if it is a strong or weak acid or base. Good things to test include anything in the refrigerator: orange juice, pickle juice, milk, water, soda etc. With parental

supervision you may want to try some of the cleaners they use for the kitchen or bathroom, maybe even dish soap!

### Advanced experiment (optional): Create your own indicator

An indicator is a solution that turns a certain color when an acid or base is added to it. It is what is on the pH paper that makes it turn colors when you dip it in an acid or base. Red cabbage can be used as an indicator for acids with pH's between 4 and 6. You can prepare the cabbage juice one of two ways...

1) Chop half a red cabbage and place it in a container for boiling. Add water to just cover the cabbage. Boil for 15 minutes then remove the cooked cabbage and discard it. Add the other half of the uncooked cabbage to the juice in the pan and boil it for an additional 15 minutes. Remove the cabbage and discard. Pour juice into desired container.
2) Cut up ¼ head of red cabbage and put it into a blender or food processor. Just cover with water and blend the cabbage into a slurry (1-3 minutes). Pour the slurry through a strainer collecting the juice in a container.

You can split up the cabbage juice into different cups and add different solutions (juices, soda, etc) and watch the cabbage juice change color. Around pH four the cabbage juice will be a pink color. At pH five it will be a dark purple. At pH 6 it will change to blue color. From pH 7 and up it will be a green color.

## 2) Density

What is density? How does it affect us? What is something that has a low density, high density?

Everything around us has density: air, solids, and liquids. Density is the amount an object weighs for the amount of space an object takes up. The amount something weighs is called mass. The amount of space it takes up is called volume. Just because something weighs more than another doesn't make it more dense - we have to take into account the amount of space it takes up (its volume). How much of it is there? For instance, take a box. If we have nothing inside but air and we weigh it, it will be less than if we fill it with water and then weigh it because water is denser than air. (Water weighs more than air even though they take up the same amount of space.) A balloon would work the same way. Fill it with air. Take another balloon and fill it with water so both balloons are the same size. Which is more dense? (The water balloon because is takes up the same amount of space but it heavier.)

### At home experiment: Dancing Raisins

For this experiment you will need fresh raisins (it won't work if they're stale) and cold, clear soda pop or seltzer water. Fill a tall clear glass with the soda. Add a few raisins. What happens? Do you know why?

Bubbles of carbon dioxide gas attach to the surface of the raisins. The volume (amount of space the raisin takes up) of the raisin and the gas is greater than the raisins were without the gas; however, the mass (amount of weight) stays about the same because the gas bubbles are very,

very light. So the raisins and gas now take up more space even though they weigh the same. This change is just enough to make the raisin less dense than the water they are in so they float up to the surface. Many of the bubbles "pop" at the surface, reducing the volume (space the raisin takes up). This makes the raisin more dense than the water, and the raisin sinks again. The process repeats until all the carbon dioxide bubbles stop. (The soda goes flat).

## Advanced Experiment (optional): Which egg is which?

You will need 8 raw, very fresh eggs and 6 raw old eggs (at least a month, but the older the better). You will also need 7 glasses of water. In glass one put one tablespoon of salt, two in the second, three in the third, and so on until you have six tablespoons in glass six. Save one glass (glass 0) and put no salt in it. There are two parts to this experiment.

1) Hard boil one of the fresh raw eggs for 10 minutes. Allow it to cool in tap water. Spin the hard-boiled egg on the table and then spin the raw egg. Can you see a difference?

The difference in spin between the two eggs in the first part is caused by differences in density. The hardboiled egg is solid inside therefore moving with the spin more easily. The fresh egg has a liquid center which resists spinning.

2) Determine which of the remaining eggs are denser by putting them in the different glasses. Can you tell the fresh eggs from the old eggs?

The second part of this experiment relies upon the difference in the density between fresh and stale eggs. As eggs age the mass (weight) of the liquid inside decreases because moisture evaporates through the shell. This reduces the total mass (weight) of the egg but its volume (space it takes up) remains the same because the size of the shell stays the same. So an egg becomes less dense as it ages. When fresh and stale eggs are tested in salt solution of different densities, the fresher, more dense eggs float in the solutions with more salt. The older eggs float in the less concentrated (less dense) salt solutions.

## 3) $CO_2$ Interactions

Where is carbon dioxide found in the atmosphere?
What do we breathe? What is carbon dioxide like?

Carbon dioxide ($CO_2$) is a gas in the air we breathe. When people breathe, we breathe out carbon dioxide. Plants use carbon dioxide (they "breathe" it in through their leaves) and give us oxygen that we breathe in. Carbon dioxide is denser than air. It gives us the bubbles in our soda. Because it's found in a lot of places and does many interesting things, it is good to learn more about it.

## Take home experiment: Pop top canisters

For this experiment you will need some Alka Seltzer tablets and a black and grey film canister. Safety glasses should be worn and care should be taken not to point the canister at any person or at anything breakable. Place about ¼ - ½ of an Alka Seltzer tablet in the film canister with a

tablespoon of water and cap it tightly. Place it on the ground and stand back. What do you think will happen? Why?

The Alka-Seltzer contains a special chemical called sodium bicarbonate. When the Alka-Seltzer tablet mixes with water, a chemical reaction takes place. The reaction makes Carbon dioxide which you can see as bubbles in the water. Because we cap the container, the carbon dioxide takes up more space (volume) in the film canister than the Alka-Seltzer and water did. Eventually so much carbon dioxide is made that it doesn't fit in the film canister, and the top pops off. The tablets are an antacid. An antacid is a strong base that helps take away acid from your stomach. This makes you feel better when you have an upset stomach. (try a pH test on the Alka-Seltzer-water mixture left in the film canister.)

## 4) Polymers

What are polymers? Where are they found?

A polymer is a long chain of the same kind of parts that can be hooked together. The parts of a polymer are so tiny you cannot see them. They are called monomers. Plastics are a great example of a common polymer. Polymers also make up a lot of the parts in our bodies.

### Take home experiment: Gluep/slime

For this experiment you will need laundry borax (sodium tetraborate decahydrate), white glue (Elmer's works well), and food coloring is optional. Mix one tablespoon of borax in one cup of water and stir to dissolve the entire solid. Mix two tablespoons of glue with two tablespoons of water and mix well. This step can be made easier if you can do this in a jar, or some type of container that you can cover and shake to mix instead of stirring.

Take the two tablespoons of glue/water mixture and add 1-2 drops of food coloring if desired. Stir in two teaspoons of borax solution. Continue stirring until a mass of "gluep" forms on the stirring utensil. It may be easier to stir with a popsicle stick or plastic spoon so you can discard it when finished.

Gluep is a polymer gel. Gluep is made from something called polyvinyl acetate which forms big long chains of tiny monomers. The gluep polymers are very long. They get in each other's way like long jump ropes getting all tangled up. This is what causes the glue and water mixture to be very thick. The borax and water solution is what ties the different polymer chains together. We give it the name of crosslinker. When we add the crosslinker, the gluep is even more thick and sticky than the starting glue and water solution.

### Advanced Experiment (Optional): What is a Polymer

Polymers are very important molecules in our lives. So it is important to know how they work. You will need 24 paper strips cut thin and long and a glue stick for this experiment. Make two long chains of ten links each. Place the two chains next to each other (parallel). Can you move the chains easily? Do they get in each other's way? A little? A lot?

Each link is a monomer. The chain is a polymer.

Now make two short chains of two links each and attach them (perpendicular) to the parallel chains. (See below) These short chains are the crosslinkers. Is it more or less difficult to move the chain now? Do they move in the same way as they did before??

_ _ _ _ _ _ _ _ _ _ polymer chain

| | Crosslinkers
| |

_ _ _ _ _ _ _ _ _ _ polymer chain

The crosslinkers make movement more difficult. This is similar to adding borax to the glue solution. The chain here gets more inflexible as the gluep got thicker.

## 5) Light

What is light? What are different ways that light is produced?

We think of light as something we can see. Light comes in many different forms such as rainbows. Some light comes in forms people cannot see. Light travels very, **very** fast (about 186,281 miles or 300,000 kilometers per second). Light comes from many different things like fire or things that glow in the dark. (chemiluminescence, bioluminescence, etc.)

### Take Home Experiment: Sky Blue-Sunset Red

For this experiment you will need a dark room, a flashlight, a white piece of paper, a clear glass jar filled half way with water, milk, and an eyedropper.

Turn off the lights in the room. Place the white paper behind the jar. Shine the flashlight through the jar so that the light hits the paper behind it. What color does the light beam appear as it passes through the water? Stir 2-3 drops of milk in the jar and observe the beam of light as it passes through the mixture. Has it changed color? Add more milk by the drop. Stir and try the light after each drop. Does the color of the beam continue to change? When does it stop? Why does this happen?

When we pass light through the jar and liquid, some of the light bounces off the water or milk. When there are no drops of milk added, more light can pass through the solution. As more milk is added, more light bounces off and less light actually passes through the water and milk solution.

Different colors of light have different wavelengths. Blue has a short wavelength; yellow has a medium wavelength and red is the longest. The shorter the wavelength, the more it bounces off the water. So, blue light will bounce more than yellow light. Red light will bounce the least. White light (as in the flashlight) contains all colors. Just like sunlight contains all colors of the rainbow.

As more milk is added, the color of the light seen on the white paper behind the container becomes redder. This is because the shorter wavelength blue light is bounced off the water more than the longer wavelengths of yellow and red light. Eventually so much milk is added so that no light passes through the mixture, and no light reaches the paper.

The sky is blue for the same reason. Very small pieces of dust and other things in the air, are like the "milk" of our experiment. Generally, a clear sky appears blue because the blue light is

scattered more than light of other colors. (Although violet light is scattered even more than blue light, our eyes are more sensitive to blue than violet, so the sky appears blue.) At sunset and sunrise, the light from the sun reaches our eyes only after traveling through a thicker layer of the atmosphere. Since blue is scattered more, the light reaching the eye is richer in red, causing red sunrises and sunsets.

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